American Gas Association MONTHLY

Gas Industry War Activities

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Radiophone Communication

•

20 Years of Design Research

•

Industry's Post-War Planning

•

War Metal Treating with Gas

April 1943

VOLUME XXV NUMBER 4

"What else can I do to help?..."

Of course, you are helping now! Buying War Bonds, working for the Red Cross, giving time to Civilian Defense. But there are other ways you can help—right in your daily homemaking routine. Below, your Gas Company suggests three that are vitally important:

SAVE FOOD...it's as important as bullets.

Plant a victory garden and preserve your surplus

Put up as many fruits and berries as possible Your Gas range makes canning easy.

Cook only the amount of vegetables needed Serve leftovers creamed, in casserole dishes, or cold—in salads

Cook vegetables and fruits in their skins whenever possible—and over a *low* Gas flame

Roast meats at low temperature in your Gas oven to reduce shrinkage. Use left-overs in stews, hash, meat pies

SAVE VITAMINS...you need 'em to be strong.

Cook vegetables in as small an amount of boiling water as possible. The flexible Gas flame will give you the exact degree of heat you need.

Cover vegetables and bring to boil quickly over full Gas flame, then turn flame low, cook gently

Do not use soda in cooking green vegetables It destroys vitamins. Cook vegetables shortest possible time

Store fresh vegetables in hydrator of your Gas refrigerator to help preserve perishable vitamins

SAVE GAS...it's needed to make tanks and guns.

Plan complete oven and broiler meals to economize on the use of Gas.

Do not light your Gas oven or broiler too far in advance. Remember—Gas is fast.

Avoid using small pans on large or giant burners.

Do not turn the Gas flame any higher than necessary

Keep the burners clean. With just a little care your Gas range will give good, dependable service for many years—there are no fragile parts to wear out.

ASK YOUR GAS COMPANY for specific information on how to cook and process food for wartime meals.

AMERICAN GAS ASSOCIATION

GAS *is vital to war production... use it wisely!*

Buy War Bonds today—save for the Certified Performance Gas Range of Tomorrow

American Gas Association MONTHLY

CONTENTS FOR APRIL 1943

Gas is doing a real job on the war front. Abundant proof that the industry is "on the beam" in its war contributions was presented at the A. G. A. Detroit Conference and the annual New England conference. . . . In a paper presented at the latter meeting, which opens this issue, Ernest R. Acker, able chairman of the War Activities Committee, brings the industry up-to-date on recent work of his committee. . . . There are a lot of things cookin' with gas that the Axis won't like—and the behind-the-scenes story of equipment research and development which made this possible is one of the greatest business stories of all time. E. G. de Coriolis tells it with gusto, and with many examples taken directly from the war production line. He is backed up by John P. Brosius who further elaborates on this industrial gas achievement. . . . For post-war planners, there is ample meat in Chairman Beebee's master plan, as well as sidelights by C. V. Sorenson (industrial and commercial gas development) and G. E. May (gas air conditioning). . . . Other features in this issue which couldn't be rationed: emergency communication by radiotelephone, war industry gas supply, ore reduction, depreciation, and spillage characteristics of hoods.

PAGE

127 War Activities—Gas Industry Meets the Challenge of the Times.....ERNEST R. ACKER
130 Emergency Communication by Radiotelephone .....HARRY J. KEELING
135 Supply of Gas to War Industries.....BRIG. GEN. WALTER B. PYRON
136 Operation of Limitation Order L-31 in the Ordnance Department.....LT. COL. R. B. HARRIS
137 Equipment Progress—Twenty Years of Industrial Gas Research and Development.....E. G. de CORIOLIS
143 Comfort in Business—Air Conditioning Small Commercial Establishments with Gas.....G. E. MAY
147 Ore Reduction—Use of Gas in Republic Steel's New Sponge Iron Plant.....JOHN J. CRAIG
149 Natural Gas Conference to Spotlight War Emergency
150 Safety Trends.....W. T. ROGERS
151 New England Meeting Accents War Demands
153 Personal and Otherwise
155 Gas and Electric Industry Accountants To Meet in Cincinnati, April 27-28
156 Depreciation in Perspective.....H. C. HASBROUCK
158 The Gas Industry's Post-War Planning Program .....A. M. BEEBEE
161 Industrial and Commercial Gas Conference Reviews War Contributions
162 What the War Period Is Doing to Metal Treating with Gas.....JOHN P. BROSIUS
164 Improving the Outlook for Industrial and Commercial Gas in the Post-War Period.....C. V. SORENSON
167 Distribution Conference in Cincinnati To Clarify Wartime Operating Problems
170 Predicting Spillage Characteristics of Water Heater Draft Hoods.....MILTON ZARE
176 Personnel Service

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No rationing for the fighting men! These sizzling steaks and baked potatoes being cooked on gas ranges at the Navy's preflight school at Iowa City, Iowa, provide one good reason why home consumption is restricted. A single meal at this training center requires 2,000 prime meat cuts.

American Gas Association MONTHLY

JAMES M. BEALL, *Editor*

WAR ACTIVITIES
...Gas Industry Meets the Challenge of the Times

By ERNEST R. ACKER
Chairman, A. G. A. Committee on War Activities

SEVEN years ago it was my privilege to address the annual meeting of this Association on the subject of "Public Relations." Today I am asked to discuss with you the "Gas Industry's War Activities." I welcome this opportunity, not only because of my high regard for the work of your Association and for the outstanding contributions made by many of your members to the war activities of the industry, but also because my subject is in a broader and more significant sense an extension of my previous subject—"Public Relations." The gas industry is today a vital part of the greatest public effort that has ever been organized and maintained in this country. The industry's relationship to this effort is one of high responsibility as a necessary unit in a complex social, military and industrial structure dedicated to the preservation of freedom and the suppression of slavery throughout the world. In this sense our former concepts of public relations are dwarfed by the responsibilities and opportunities of the present.

Major Forward has already summarized in his characteristically direct manner the response of the gas industry to the challenges and the problems with which we are faced. The industry is fulfilling its obligations and meeting its public duty in a manner which has continuously won the commendation of governmental agencies and has clearly demonstrated the ability of the industry to adapt itself quickly to new conditions and to face emergencies with courage and resourcefulness.

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Much has been said of the remarkable accomplishments of our manufacturing industries in changing overnight from peacetime to wartime production. In this connection, I am impressed by the following quotation from the annual report to stockholders of one of the New England companies: "The accomplishment of the tremendous task of converting industry from peacetime to war production quite naturally attracted wide attention and acclaim. As a stockholder in this company, you may have wondered why it was that the electric and gas industry shared in this public glory to a very minor degree. The reason is, of course, that your company, in common with most utilities in the country, was already prepared to meet increased demands for power and gas when our nation entered the war. There is nothing very spectacular or dramatic about being prepared and, therefore, the press and the public paid scant attention to the utilities. However, we take pride in the fact that we were prepared and that little of the industrial expansion could have been accomplished without adequate electricity and gas." I am satisfied that this statement applies to the gas industry generally and that any limitations now placed upon supply come as a result of material and transportation shortages for which the gas industry is not responsible.

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The war activities of the gas industry are kaleidoscopic in nature, ranging from questions of materials and supplies, production capacity and manpower to questions of conservation, curtailment, nutrition, etc., and even of whether the industry should mobilize its resources to promote the victory garden idea! New questions and new problems arise daily requiring analysis, consideration or review by competent and qualified groups. Many of these matters are referred to the American Gas Association's Committee on War Activities which acts as a clearing house in routing them to the proper committee for consideration, in receiving recommendations and in taking such action as may be required in each particular case.

In this work the committee has had the full cooperation

Presented at the Annual Meeting of the New England Gas Association in Boston, March 18, 1943.

of all sections of the Association, and has depended to a great extent upon the able assistance and guidance of Major Forward and his Headquarters Staff who are largely responsible for anything which may have been accomplished. Major Forward has referred in very complimentary terms to my own work in connection with the war activities of the Association. I appreciate his confidence and his commendation, but cannot help but point out that no such job is done by one man and that any success which we have had to date is only the result of the coordinated effort of many individuals who have given freely of their time and ability in meeting the demands of the war situation. I consider my present assignment as a great opportunity and can only hope that any personal contribution which I may make will live up to the needs and expectations of the industry.

War Contribution Objective

The function of the Committee on War Activities is to consider all matters relating to the war effort and to take such action as will assure the greatest possible contribution to the prosecution of the war with the minimum dislocation of the essential services of the industry to its customers. In this connection the committee has been called upon to represent the industry in various discussions with governmental agencies, and has been continuously impressed with the consideration which it has received on all matters relating to our common purpose. The industry is extremely fortunate in the high caliber of the personnel of the War Production Board assigned to handle gas industry problems, and may rest assured that no action will be taken without complete review of all pertinent facts and a full opportunity for presentation of the viewpoint of the industry.

The most recent example of the procedure adopted by the Manufactured Gas Division of the Office of War Utilities, is in the prolonged discussions of the proposed substitution of low grade gasoline for heavy oils now used in water gas production. This proposal, advanced some months ago by the Office of the Petroleum Administration for War, held such far-reaching implications for the gas industry that it became the immediate concern of officials of the War Production Board charged with the responsibility for the maintenance of adequate gas service for war industries and the civilian population. As a result of the efforts of officials of the Manufactured Gas Division of the Office of War Utilities, and the Natural Gas and Natural Gasoline Division of the Petroleum Administration for War, the gas industry was given a full opportunity to present its case and to review the effect of the program on its operations, with all of the governmental agencies involved. Representatives of the gas industry were advised of the desperate situation in District 1 with respect to heavy oils and were asked to examine with governmental agencies the possibility of relieving the situation by using surplus gasoline available in Districts 2 and 3 in place of heavy oils urgently needed by the Navy, Merchant Marine and other war industries. In these discussions, representatives of the industry have stressed particularly the extreme hazard involved in storing and using gasoline in existing water gas plants. In addition, they have pointed out the great economic loss involved in adopting such a program.

Heavy Oil Use

The water gas companies in District 1 use approximately 5% only of the heavy oil used in that district, and have continuously urged that readjustment of oil production at the source or conversion of other industries to gasoline could be accomplished with much less economic loss than in the case of the gas industry. A memorandum setting forth the position of the industry will shortly be filed with governmental agencies in Washington.

You are all familiar with War Production Board Order M-43b restricting the use of tin solder for the repair of gas meters, and with the confusion which has resulted in some states because of the conflict between the provisions of this Order and those of existing orders of state regulatory bodies. In many states amendments to existent regulations have already been adopted to avoid such conflict. In other states, however, the question is still undecided and gas companies are at a loss to reconcile the requirements of the federal order with those of their state commission.

At the request of the Committee on War Activities, the Technical Section of the American Gas Association is now conducting a survey of the action taken by state commissions throughout the country and this survey will shortly be available to member companies. In most states existing regulations require periodic meter tests on less than a 12-year cycle and prescribe limits of accuracy considerably narrower than those contained in the federal order. In some states no meter may be reinstalled on a customer's premises without the index having been set back to zero, so that even though the meter may test within the limits of accuracy required, it cannot be put back in service without having the top removed, the index adjusted and the top resealed. Strict adherence to the regulations of the War Production Board and to those of the state commissions will in many cases result in the accumulation of a large stock of unrepaired meters and the early exhaustion of existing stocks of available meters.

Meter Action Needed

Recent discussions with representatives of the Tin Branch of the War Production Board indicate that the 4% accuracy limitation will be maintained and that the War Production Board will not take jurisdiction over the removal of meters from service. For this reason, constructive action by state commissions is imperative. One of the member companies of the American Gas Association has filed an appeal with the War Production Board covering the repair of meters that are mechanically defective, and the committee is advised that favorable action will probably be taken in the near future. Three companies have filed appeals requesting permission to be allowed to continue their regular schedules of meter repair with the understanding that no tin solder would be required other than that recovered from meters brought in for repair. In one case the appeal was granted for a period up to June 30, 1943; in the second the appeal was denied on the grounds that the company was located in a labor shortage area; and in the third no action has been reported as yet. It appears that no general

amendment to the Order will be made to cover such situations but that each case will be considered on its own merits. In all three of these cases it has been the practice of the companies in the past to use a tin solder having higher than the usual 50% tin content.

I have already said that the work of the Committee on War Activities covers a wide variety of problems and I shall touch on only a few more of the highlights at this time, leaving the remainder to become matters of record and the subject of leisurely reading and reminiscing after the war is over. Some of the more interesting activities are those having to do with critical materials. We have recently been asked, for instance, for a firm estimate of the amount of cast iron and steel piping required by the gas industry during the 12-month period beginning July 1 of this year. These estimates are for use in the allocation of critical materials under the Controlled Materials Plan. Similar estimates have been requested covering the number of conversion burners that will be required to replace old burners during the next 12 months.

Many of these estimates must be made in a limited period of time, so that the basic information is assembled from data available at Association Headquarters and modified by a quick check with representative gas companies in order to conform it to current conditions. The cooperation of member gas companies in connection with these and other inquiries of the committee has been outstanding, and I wish to take this occasion to express my great appreciation for the prompt and effective help which they have given us.

Critical Material Study

It is an ill wind that blows no one good, and some of our competitors have used the present shortage of critical materials as an opportunity to discredit the gas industry's services, particularly in the residential field, as constituting a waste of iron, steel, copper, brass, and other critical materials. In answer to this challenge and as a guide to governmental agencies and the industry in formulating gas service plans for housing projects, the Association has recently completed "A Study of Utility Services for War Housing."*

* See March A. G. A. MONTHLY, pages 97-101.

The advantages and disadvantages of providing housing projects with cooking, refrigeration, water heating and house heating services with various combinations of fuels and in accordance with "War Housing Utilities Standards" are fully discussed and clearly disprove allegations that gas service is wasteful of critical materials.

As an outgrowth of this study, the Association is now investigating the possibility of utilizing non-metallic substitutes for main and service extensions in connection with war housing projects. This investigation has been undertaken at the request of governmental authorities with the thought that such extensions could be installed at government expense and abandoned at the end of the war. One non-metallic material which appears to offer particular promise, at least on a temporary basis, is now being tested with the cooperation of the gas companies in Pittsburgh and Washington. The use of such materials would obviously improve the position of gas service from the standpoint of weights of critical materials required.

Defer Use of Gasoline for Gas-Making

THE proposal of the Petroleum Administration for War that gasoline be substituted for present enrichment oils used by companies manufacturing water gas in District 1, has been deferred indefinitely according to government officials. While the question has been eliminated for the near future, companies in that area are asked to continue supplying data already requested by the Committee on War Activities of the American Gas Association.

In compliance with requests of the federal government, the gas industry has made an outstanding record in promoting the conservation of gas as a vital fuel, and the curtailment of gas usage in areas of critical oil shortage. The conservation and curtailment advertising programs prepared at Association Headquarters have been utilized by a substantial portion of the gas industry and the activities of the industry in this regard have been commented on favorably by the governmental agencies involved. The sales records of the gas companies which have cooperated in these programs indicate in most cases that the consumption of residential and house heating customers has been materially reduced after giving consideration to degree day differences. In some cases consumption has remained at previous levels, other influences to the contrary, while in only a few cases consumption has increased.

In this connection it seems obvious that neither the gas industry nor the government can expect that the total consumption of gas per customer can in all instances be reduced through such campaigns. It must be borne in mind that many more people are cooking at home than in the past, and that the government programs directed to the canning and conservation of foods, the improvement of nutrition and the doubling up of families in housing shortage areas, all operate to increase consumption per customer in spite of conservation programs. Under the circumstances an over-all reduction of 10% in combined residential and house heating usage is considered by some governmental representatives as indicating a satisfactory response to the conservation program. In the final analysis, I feel that the best that we can hope to accomplish is to influence each customer to utilize the minimum amount of gas necessary for his individual needs, whether they be cooking, refrigeration, water heating, or house heating, bearing in mind always that if these operations were carried on by any other means, more oil or more new equipment would be required than is used at the present time.

House Heating Conversion

Shortly before the first of the year, the Association received a communication from the Office of the Petroleum Administration for War, suggesting that the gas industry undertake a campaign to persuade its house heating customers using conversion burners, to convert their heating plants back to the use of coal. A detailed analysis of this question indicated that the average consumption per gas house heating customer in the Atlantic Seaboard States was 241,000 cu.ft. annually, and that of this average consumption 141,000 cu.ft. represent the portion produced with water gas. This average

(Continued on page 175)

Emergency Communication by Radiotelephone

By Harry J. Keeling

Mechanical Engineer, Southern Counties Gas Co. of California

Harry J. Keeling

A natural gas public utility, dependent as it is upon long transmission pipelines for its source of supply, is vitally interested in communication. This was brought forcibly to the attention of our company during the reconstruction periods following the earthquake in 1933 and the severe rains in 1938, when normal communication channels were disrupted by either actual physical damage, or due to congestion resulting from the large volume of traffic.

The Southern Counties Gas Company system covers an area of about 700 square miles, and its pipelines extend from San Diego, 115 miles south of Los Angeles to Paso Robles, 250 miles north of Los Angeles. These pipelines traverse rough terrain and cross innumerable streams and canyons, many of them inaccessible by automobile. The difficulty of repairing line breaks resulting from landslides and floods was greatly increased by the lack of communication from bank to bank, and from the scene of the trouble to district headquarters. Swollen rivers washed out public telephone lines, seriously interfering with gas dispatching operations between towns.

Our experience with these catastrophes showed a definite need for emergency communication of three types:

1) Short range communication (1 or 2 miles) for use on opposite sides of a stream or canyon to facilitate the installation of emergency pipelines where bridges have washed out taking pipelines with them.
2) Medium range communication (5 to 20 miles) for sending information or orders between the site of the break and the district headquarters.
3) Long range communication (20 to 60 miles) for exchanging messages between the district headquarters and the Los Angeles General Office, or between the district headquarters and field emergency crews working a considerable distance away.

Obviously the radiotelephone provides the most practical solution to the above requirements.

In the early part of 1937 when our company investigated the radio equipment on the market, we found that there were practically no standard units available which would be suitable to our needs. Because of the expense involved in developing custom built equipment, the management decided to purchase a pair of short range portable units which could be "staked out" on opposite sides of a river ready for use in case the bridge washed out. These sets could be used for training operators and gaining experience be-

Figure 1—Diagram showing the typical operation of the Southern Counties Gas Company radio communication system. By means of the equipment illustrated, information from a line break in the mountains at a remote point may be relayed directly to the General Office in Los Angeles

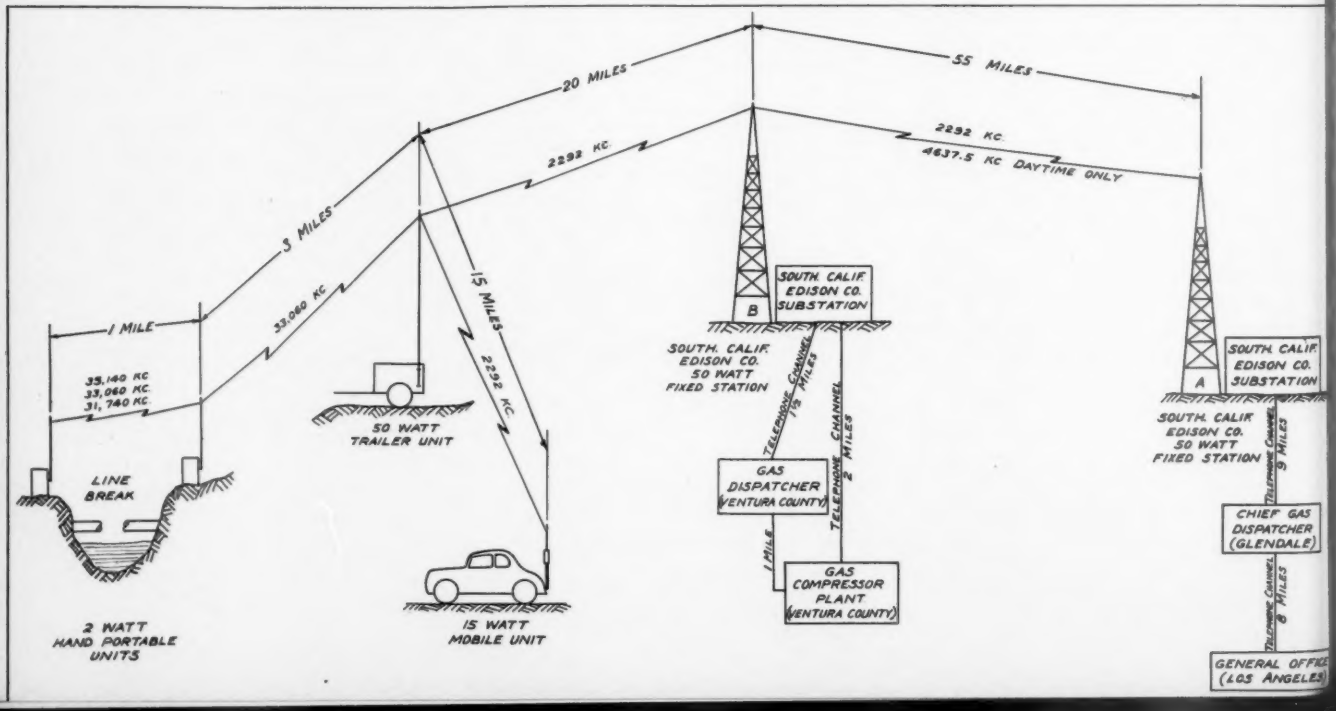


Figure 2—When clipped to a hiking "back pack" the 2-watt set becomes a "walkie-talkie." The operator has paused in his trip up the mountainside here to report to other units nearby

Figure 3—The 2-watt portable radiotelephone unit. The removable legs raise the set out of the damp grass. Batteries may be seen in the lower compartment. (The operator is reporting information to headquarters)

Figure 4—Coupes equipped with 15-watt radiotelephone transmitters—one with a conventional whip antenna and the other with the new "center loaded" antenna

fore investing in more elaborate and expensive equipment. Our first application to the Federal Communications Commission was made in May, 1938, but it was not until March of the following year that a radio license was granted.

These first two sets were so successful that in December, 1940, four additional 2-watt units were purchased. In September, 1941, two 50-watt trailers and five 15-watt mobile units were added, bringing our investment in radio equipment to a total of about $9,000. This equipment will be described more fully below.

Federal Restrictions

All use of radio equipment comes under the jurisdiction of the Federal Communications Commission. This governmental body, under the authority granted it by the Communications Act of 1934, has issued rules and regulations which must be observed by all those who operate radio transmitting equipment. Strict supervision is required because of the large number of agencies dependent upon radio equipment, and the limited number of usable frequencies. In general it is not possible to grant exclusive privileges to one individual or group; therefore, close cooperation between stations is a necessity to minimize interference and congestion.

The provisions under which public utilities may use radio equipment comes under the "Special Emergency" section of the "Emergency" service. As defined by the Federal Communications Commission, the scope of service for special emergency stations is:

> "Special emergency stations may be used only during emergencies jeopardizing life, property, public safety, or for essential public service, or when such an emergency is imminent, for communications relating thereto and for other essential communications. They may be used
>
> (a) for transmission from one point to another between which normal communication facilities are not usable or are temporarily inadequate, or
>
> (b) for transmission to or from mobile units."

The Federal Communications Commission in its regulations states that emergency stations must maintain a log of all their radio transmissions, and the operator must be prepared at all times to justify to the Commission the emergency nature of the traffic handled.

Early in 1939, the Federal Communications Commission assigned two frequencies in the radio spectrum for the exclusive use of public utilities in the emergency service. Frequency 2292 kc. is available for communication between fixed stations, between fixed stations and mobile units, or between mobile units. The frequency 4637.5 kc. is available for daytime use only, between fixed stations which are separated by distances such that reliable communication between them is difficult at 2292 kc. The use of these frequencies by public utilities is contingent upon such use not causing interference with established services, and licenses may be canceled without notice if such interference results.

Operators

All persons operating radio transmitting equipment or repairing and adjusting it must be licensed to do so by the Federal Communications Commission. Any adjustments to the transmitter that may affect the proper operation of the apparatus must be made by someone holding a Radiotelephone Operator's License, Second Class or higher. If the transmitting equipment is constructed with foolproof controls so that it is not easily put out of adjustment, it may be operated by a person holding a restricted Radiotelephone Permit. No technical knowledge is required for this permit. The person applying for it must show that he is, 1) a citizen of the United States; 2) familiar with the laws and rules and regulations governing the operation of radio equipment, and; 3) familiar with the operation of the sets he may be called upon to use.

About 40 of our company employees have received the above permits. These operators are distributed throughout the system, in all departments, so that no matter in which district an emergency occurs, there is always an operator in that district who is familiar with the local conditions. Because of the expense involved, it was not practical to equip all districts with radio equipment so that the entire company territory would be covered by a radio network at all times. As a compromise, the equipment is stationed rather widely throughout the system, with apparatus located on opposite sides of major rivers which in past catastrophes have disrupted communication lines or washed out gas transmission pipelines.

This dispersion results in the most efficient use of the radio equipment. In case of disaster in a particular area, the surrounding districts are notified and other equipment is quickly brought up to the scene of the trouble.

Maintenance of Equipment

Our radio equipment is maintained and adjusted by a specialist on a monthly contract basis. This man holds a Radiotelephone Operator's License First Class, and it is his responsibility to see that the transmitters operate in the manner prescribed by law, and the operators comply with the Federal Communications Commission's rules and regulations regarding the handling of the units and keeping of the requisite operating logs. This specialist makes regular monthly trips to the various districts where he checks our equipment and also the equipment owned by two other gas companies, Pacific Lighting Corporation and Southern California Gas Company. By cooperating with these two gas companies who operate radio equipment, arrangements were made whereby equipment owned by these companies could be checked on the same trip. By combining the work of three companies in this way, considerable saving in mileage and expense is possible.

Description of Equipment

The advent of the war interrupted our program for adding additional radio equipment to our system. Following is a description of the apparatus we used for short range, medium range, and long range communication by radiotelephone. All this equipment was custom built to our specifications by the Radio Communications Company of Los Angeles.

2-Watt Portable-Mobile Unit—This apparatus is used for short range communication, as for instance from opposite sides of a stream or canyon which is inaccessible by car *(Figure 3)*. The units cost about $250 each, and comprise transmitting and receiving equipment mounted in a weatherproof wood box with an 8-foot collapsible "whip" antenna mounted on the side. When they are to be carried for long distances on foot, the boxes are clipped to standard back pack frames of the type commonly used for carrying equipment on a hike *(Figure 2)*.

The entire unit weighs about 56 pounds. This is rather heavy "walkie-talkie" equipment; however, extreme portability was sacrificed in order to obtain longer operating life from the dry batteries which supply power. The batteries, inclosed in the wood case with the sets, are capable of operating the receiver for 27 hours continuously, and the transmitter for 9 hours when used intermittently. The sets are equipped with removable legs 6" long which raise the units off the ground. These legs are used when it is necessary to place the apparatus on muddy or wet ground.

The equipment transmits and receives on three frequencies in the ultra-high-frequency band, 35,140 kc., 33,060 kc., and 31,740 kc. There were two reasons for choosing more than one operating frequency: 1) This feature permits several pairs of units to work in the same location without mutually interfering with each other; 2) When receiving conditions are unsatisfactory on one frequency, it will usually be found that the reception is satisfactory on one of the other frequencies.

Figure 5—The 50-watt trailer unit with the 35-foot antenna partially extended and the canvas cover raised to show the generating unit in its steel case at left, and the radio sets in the larger steel case at right

Because the ultra-high-frequency waves travel in a direct line like a beam of light, these 2-watt sets do not operate well where there are physical obstructions, buildings, hills, etc., between the two units. Our experience indicates that they will give satisfactory and dependable communication over a distance of half a mile when used on the ground in city streets, and two miles in outlying country containing no obstructions. We have successfully been able to provide communication of this type for distances of five or six miles by locating the sets on the top of high buildings or hills or by using hydrogen-filled balloons to support vertical antennae.

The ultra-high-frequencies are definitely the most valuable for short range work. Operators working with units on opposite sides of a canyon are not bothered by interference from signals from distant but more powerful stations because of the shielding or screening effect of the surrounding hills. When lower frequencies are used, operators working at a remote point in the mountains sometimes find that their work is interfered with by strong signals from stations many miles away.

Figure 6—Close-up of gasoline-driven generator mounted on the 50-watt trailer. The watertight steel cover, which may be raised to start the engine and to provide ventilation when it is running, has been removed. Note the muffler connection

15-Watt Mobile Unit—The 15-watt mobile installations consist of standard Motorola ultra-high-frequency transmitting and receiving units rebuilt to operate on medium frequency (2292 kc.). They are designed to be permanently installed in the luggage compartment in the rear of a conventional coupe or sedan passenger car *(Figure 4)*. The installed cost of these sets is about $500. The equipment is energized from the 6-volt auto battery and contains no other auxiliary power supply.

Four of these units are installed in coupes, and one is installed in a pick-up truck. The truck is equipped with a 35-foot collapsible self-supporting antenna. Although the set can be operated with the truck in motion and the

antenna fully extended, this is seldom done because of limited highway clearance. Ordinarily, the truck is operated with only the upper "whip" part of the antenna extended, making the overall height about 15 feet. When first installed, our coupes were equipped with a 10-foot "whip" antenna mounted on the rear bumper. We have recently developed a different type of antenna which uses a loading coil in the center.

When the weather is dry, both antennae work with about the same efficiency. In extremely wet weather, however, when there is a continuous stream of water flowing over the insulators at the base of the simple "whip" antenna, the efficiency drops to a very low value. Because of its characteristics, the center-loaded antenna works with only slightly impaired efficiency in the rain. This deficiency of the simple "whip" antenna could be corrected by more efficient insulators; however, because of wartime conditions, replacements are impossible. We are planning to change over to the center-loaded type exclusively provided sufficient materials can be obtained.

Operating Range

The dependable operating range of these units when talking from one car to another is from 5 to 20 miles, depending upon local conditions. The range depends upon: 1) the amount of noise and static from power lines, streetcars, etc.; 2) the type of soil. Along the coast near salt water, we have achieved satisfactory and dependable communications between cars at distances up to 65 miles. On the other hand, we have found that under certain conditions in some desert areas, dependable communication is not possible at distances greater than 4 or 5 miles.

50-Watt Portable-Mobile Unit—This equipment comprises two transmitting and receiving units (operating on 2292 and 30,060 kc.) housed in waterproof boxes, mounted on a trailer *(Figures 5 and 6)*. It is designed to operate on 120-volt, 50 or 60-cycle a.c. power supply through a 50-foot extension cord. Where normal power is not available, the equipment is energized from an emergency source consisting of an 800-watt Kohler gasoline engine generator unit, which is also mounted in a waterproof box on the trailer. The antenna for this 50-watt unit consists of a 35-foot collapsible "whip" type which is attached to the trailer. The unit was designed to be as versatile as possible. The two steel boxes housing the radio equipment and power supply may be demounted from the trailer and carried by hand in country where it is not possible to tow the trailer. With the gasketed steel covers closed, the equipment is completely waterproof and is instantly ready for operation even after complete submersion. The entire outfit, including the trailer, weighs 1500 pounds and costs about $2000.

Our original specifications for these trailers provided for mobile operation while the trailer was being towed by a truck, and the installation of the generator and other equipment was made so that they would operate satisfactorily under these conditions. A 50-foot microphone cable and handset, permit the operator to talk from the cab of the truck while the equipment is in motion. These sets were being completed just prior to the outbreak of the war and the manufacturer was never able to obtain delivery on certain switches necessary to change from a fully extended to a partially extended antenna. Therefore, it is not possible to operate these 50-watt units with the antenna shortened from its normal 35-foot extension to the 16-foot height required to clear highway obstructions. Although we are unable to transmit with the antenna shortened, reception is possible; therefore, it is practical to leave the receiving sets turned on while the unit is being towed, so that the truck driver can be called over the air while the truck is in motion. It is only necessary for him to stop long enough to extend the antenna on the trailer in order to answer the call.

The dependable operating range of the trailer unit under average conditions is about 25 miles on a frequency of 2292 kc. and about 10 miles on 33,060 kc. These figures are only approximate. As explained in the discussion of the 15-watt units, under certain conditions the range may be several times the figure given above.

Fixed Stations—We have found that the 15-watt mobile units and the 50-watt trailer units are satisfactory for medium range communication. However, for long range communication a fixed station with a permanent antenna is necessary. Upon investigation of suitable permanent sites for fixed stations, we found that many such proposed locations were occupied by another public utility, the Southern California Edison Company Ltd., who operate on the same frequency, 2292 kc.

Joint Utility Operation

Inasmuch as two stations cannot be in operation at the same time on the same frequency, we concluded that much could be gained by operating a single station in a given location in place of both companies erecting inde-

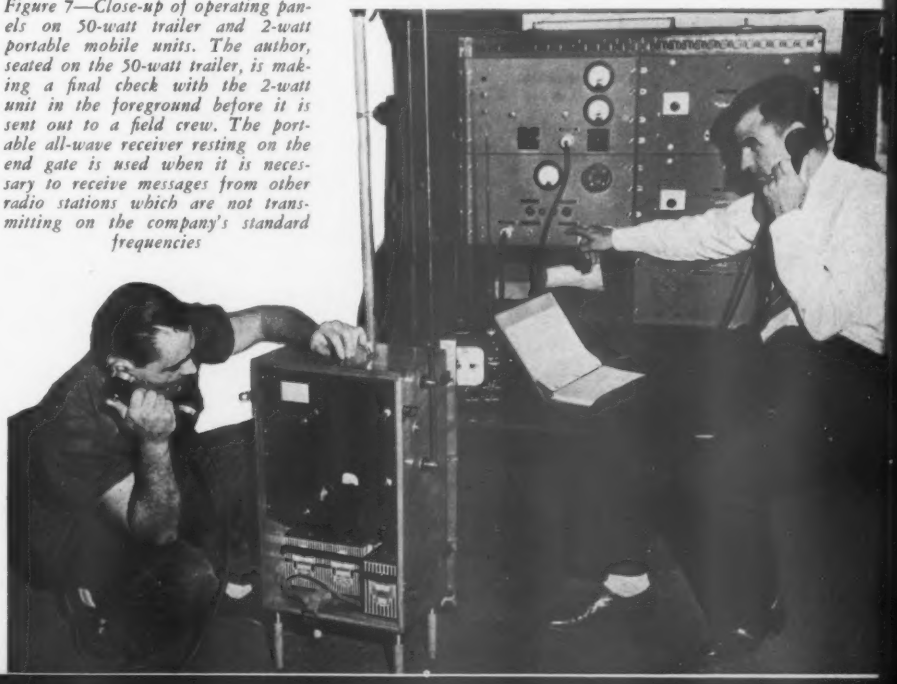


Figure 7—Close-up of operating panels on 50-watt trailer and 2-watt portable mobile units. The author, seated on the 50-watt trailer, is making a final check with the 2-watt unit in the foreground before it is sent out to a field crew. The portable all-wave receiver resting on the end gate is used when it is necessary to receive messages from other radio stations which are not transmitting on the company's standard frequencies

pendent stations. As a result of negotiations between our company and two other gas companies who were interested in establishing an emergency radio communication system, an agreement was reached whereby the three gas companies jointly shared the use of three of the Edison Company's fixed stations located in Los Angeles, Orange, and Ventura Counties.

Under this agreement, the three gas companies pay half of the fixed charges on the Edison Company's station, plus an hourly fee for the operator's time. The gas companies have a right to the use of alternate five minute periods of the operating time of these particular stations. This is a very satisfactory arrangement for both parties and permits the greatest use of equipment with the least congestion on the air.

There has been extremely close cooperation between our company and the two other gas companies, Pacific Lighting Corporation and the Southern California Gas Company, regarding the establishment of an emergency radio system. The three companies have cooperated in the purchase and in the dispersion of equipment so that duplication will be avoided. All three companies will cooperate with each other and with the Edison Company during an emergency.

Messages for transmittal over the Edison Company's 50-watt fixed station are relayed from the gas company offices either through public or private telephone channels or over the air from mobile units.

The Southern California Edison Company has fairly complete radio coverage over its system through a number of fixed stations which each have several mobile units operating in conjunction with them. Our company does not intend to establish an emergency radio communication network which will completely cover its territory because 1) of the large investment required and 2) of the limited amount of emergency traffic to be handled. When the present war is over, however, the company plans to expand its radio system by the installation of fixed stations in certain districts which are not now served. Pre-war estimates valued these proposed stations at about $5,000 complete, including antenna tower and emergency power supply.

Operation of System

Figure 1 is a diagram showing the typical operation of our various pieces of radio equipment. In this example, the broken pipeline is presumed to be located in inaccessible hills in Ventura County. The 50-watt trailer unit has been towed by the Ventura District emergency truck to a position as close as possible to the scene of the trouble and a two-watt portable unit has been carried to one side of the canyon where the break has occurred. Another two-watt portable unit has been carried to the opposite bank of the canyon by a crew working on the opposite side. Since the 50-watt trailer unit is equipped with ultra-high-frequency (33,060 kc.) and medium frequency (2292 kc.), it acts as a control station for the units operating in the vicinity of the source of trouble. The control station is capable of relaying information from either the 15-watt mobile units mounted in cars or trucks or the portable two-watt units.

Line Break Experience

Information from the line break can always be quickly relayed to either the Ventura County District Headquarters or the General Office in Los Angeles through the Southern California Edison Company's 50-watt fixed stations and the telephone channels. It is quite unusual to have all the telephone lines between the gas company offices and the Southern California Edison Company's substation out of order. However, if this possibility occurred, a 15-watt mobile unit would be stationed at the gas company plant from which messages could be relayed to the Southern California Edison Company's substation. The above example illustrates how we have, with limited equipment, fulfilled the requirements for the three different types of communication referred to in the first paragraph.

There has been no major emergency involving broken pipe lines since our radio communication system has been established. There have been several minor emergencies, however, in which the equipment has proven of definite value. We recently had an opportunity to test the operation of our system for relaying messages through the Edison Company's fixed stations to our Ventura Headquarters when heavy rains in January of this year threatened to wash out a pipeline river crossing in Ventura County. During this rain, telephone communication with our Ventura County District office was out of service; therefore messages from the General Office were relayed through two fixed stations to a 50-watt trailer unit and a 15-watt mobile unit which were operating in Ventura County. Information concerning the conditions at the river bank were quickly transmitted to the General Office through the system illustrated by Figure 1.

In another district, during this same storm, our 2-watt units were stationed on opposite sides of a flooded stream ready to assist the emergency crew which was standing by ready to install a temporary bypass in case the stream washed out the transmission pipeline. Fortunately, the storm subsided before the pipe was damaged and the emergency installation was not required.

Our two-watt units have been very useful in connection with operations on long transmission lines where it is necessary to take the line out of service temporarily for cleaning. In such cases, it is customary to isolate a section of the line by closing two valves and continue to serve consumers further down the line by "line pack." Therefore, it is imperative that the operation be completed before the transmission pressure gets too low.

The radio equipment is very helpful in this case in communicating between the field crew and the pressure measurement stations several miles downstream. In case the pressure gets dangerously low, threatening an outage of consumers on the downstream side of the closed valve, the crew can be notified immediately and the condition corrected.

When the Southern Counties Gas Company radio was set up, the wartime use was not contemplated and the equipment was not particularly designed with that application in mind. We feel very fortunate, however, that we have the equipment on hand ready for service if hostilities do come to this continent.

Mid-West Meeting Off

THE Mid-West Gas Association has cancelled its annual convention. However, the executive council will hold an annual meeting at Omaha on April 12 for the purpose of electing officers, considering reports and discussing activities.

Supply of Gas to War Industries

By Brig. Gen. Walter B. Pyron

Chief, Fuels Branch, Services of Supply, Washington, D. C.

WHEN the United States entered the second world war, 95% of the petroleum and petroleum products refined and used on the Atlantic Coast were transported to the Atlantic Coast by tanker, from the Gulf of Mexico area and Caribbean area.

In the early part of the 1942, enemy submarines started an active campaign on the East Coast, Gulf Coast, and in the Carribbean. Early in the summer of 1942, it was necessary to transfer a large number of tankers to overseas service; both in the Atlantic and Pacific. This new movement was necessary to supply petroleum products to Allied nations as well as our own overseas forces. As a result of the enemy submarine campaign and the diversion of tankers to overseas service, the tanker movements to the East Coast from the Gulf of Mexico and Caribbean areas have been reduced to a very small figure.

Oil Transportation

Due to the lack of crude oil supply in the Atlantic states, it is necessary to transport a substantial amount of crude oil to the East Coast to be used by eastern refineries in manufacturing aviation gasoline, toluene, butadiene, as well as other petroleum products. To meet the deficiency caused by the loss of tanker tonnage, the petroleum industry, Petroleum Administration for War, Defense Transportation, and War Production Board embarked upon a program of moving oil by tank car and barges. The movement by tank car has been phenomenal.

The Petroleum Administrator for War arranged for the reversal of pipelines that had previously moved petroleum products from the East Coast to the Appalachian area, and even further west. PAW and other Governmental agencies arranged for the construction of a 24-inch crude oil line, from Texas to the East Coast. This line has been completed to Illinois, a midway point, and will have been completed to the East Coast by June, 1943. A 20-inch petroleum products line has been authorized, and will be constructed from Texas and Louisiana, to a point in Indiana where the products will be loaded on tank cars for shipment to various East Coast points. When this line is completed, it will have the effect of materially increasing the amount of petroleum products reaching the East Coast, due to a shorter tank car turn-around time from Indiana, as compared to movements from Texas and Louisiana.

The Plantation pipeline, designed for moving petroleum products from Baton Rouge to a point in North Carolina, has been extended southwest, to the Houston, Texas, refining area, and is being extended, on the northeast, to a point near Norfolk, Virginia. Pumping capacity has been added, which will result in this line having a total carrying capacity of 90,000 barrels per day.

An 8-inch products line has been laid across Florida, which will receive oil from barge movements, from Texas-Louisiana points, and will transfer it to barges and tank cars on the east side of Florida for distribution by coastal canals to the southeastern part of the United States. Additional barge lines have been, and are being implemented for use on the Mississippi River, Ohio River, Gulf Coast, and Atlantic Coast canals.

The completion of all facilities above enumerated will greatly relieve the East Coast situation but will not entirely meet the demand for off-shore shipments and essential demands for utilities and civilians on the East Coast. It is vital to the war effort that the maximum amount of natural gas, fuel oil and gasoline be made available to the East Coast. In addition to the increasing off-shore demands, many of the largest war production plants are located in the general East Coast area. Fuel on an uninterruptible basis must be furnished these plants as well as the utilities serving the war effort. Adequate fuel must be furnished to essential civilian agencies as well as domestic consumers.

To meet the necessary demands from war production plants, we must provide sufficient supplies of fuel to the civilian population to assure proper health and efficiency of those engaged in war work and essential industries. This is absolutely vital to the war effort, as a break-down in the health and efficiency of war workers would interfere greatly in the war plans.

We have struggled through a very

Brigadier General Walter B. Pyron, right, receiving the congratulations of Chairman B. H. Gardner following his appearance on the program of the A. G. A. War Conference on Industrial and Commercial Gas

Brigadier General Walter B. Pyron is the War Department Liaison Officer for Petroleum. In September, 1941 he went to Washington, D. C., for duty in the office of the under Secretary of War and in March, 1942 he became Liaison Officer for Petroleum in the Resources Division at the Headquarters of the Services of Supply.

In civil life General Pyron was executive vice-president of the Gulf Oil Refining Company. In this capacity he was in complete charge of all operations, including development and production of both oil and gas in the southern part of the United States and Mexico. Houston, Texas, has been the home of General Pyron for the past twenty years.

Address before A. G. A. War Conference on Industrial and Commercial Gas, Detroit, Mich., Mar. 11-12, 1943.

bad winter season, by the proverbial "skin of our teeth." Many emergency measures have been taken, not necessary to enumerate here, but I can say to you that there has not been a serious shut-down in any war plant or utility, nor has there been any undue suffering of civilian population.

Stocks of fuel and heating oil especially have been reduced to a dangerous level, and must be built up during the summer months to meet the heavy demands of the coming winter season. *This can, and must be done but it will require the closest cooperation of all agencies concerned with fuel of all classes, and will require the continued sacrifice on the part of the civilian population.*

The gas industry has cooperated whole-heartedly in this critical problem and deserves commendation for its prompt and effective efforts in supplying war plants, utilities, and essential industries.

While the East Coast situation is the most critical one, at the moment, *let me impress upon you that the fuel problem is nationwide in scope, and must be approached and solved from that standpoint.*

Your estimate of gas requirements no doubt indicates to you that additional wells should be drilled, additional transmission lines laid and various improvements made in your facilities. Let me warn you that the need for steel and steel products for essential military requirements is still so great that the War Production Board and other agencies having to do with the allocation of these critical materials will subject your requirements to a very close screening. The War Production Board is struggling with the Herculean task of distributing all critical materials to the agencies and useages that will best serve the war effort. I am sure that agency will have your wholehearted cooperation in these matters.

It is believed a number of things can be done by the gas industry to

(Continued on page 166)

Operation of Limitation Order L-31 in the Ordnance Department

By Lt. Col. R. B. Harris

Chief, Fuel and Power Unit, Detroit Ordnance District

IT is a pleasure to attend these meetings of the leaders of the industrial departments of the gas industry and to listen to the exchange of ideas, particularly as to how your industry can better serve the war effort.

The Ordnance Department is charged with the responsibility of procuring, inspecting and maintaining all combat material for the army and, consequently, has in force contracts totaling many billions of dollars. These contracts are for tanks, vehicles, guns, ammunition, and a multitude of accessory equipment. The continuous flow of this material to the combat areas is as important as its design and maintenance and the supply of fuels and power to the producers is necessary if this flow is to continue.

As an added precaution toward maintaining uninterrupted production of ordnance facilities, the Fuels and Power Section of the Ordnance Department was created. It has the responsibility of coordinating and controlling fuel and power supplies to ordnance facilities.

The Fuels and Power Section is authorized to deal with the War Production Board and other government agencies through proper channels and to cooperate with and assist these agencies, public utilities and war industries in matters relating to fuels and power supply.

It is responsible for all surveys, investigations and other information which is necessary for the proper control of fuels to ordnance facilities. It recommends the desired action necessary for such control to interested government agencies and responsible authorities. It assists ordnance facilities in securing and maintaining adequate supplies and sources of fuels for the maintenance of uninterrupted production. Lastly, it may direct ordnance facilities when necessary and advisable, to effect fuel conversion and to install standby equipment so that maximum operative utilization of available supplies of fuels may be obtained.

Specifically, with reference to Limitation Order L-31, this section encourages industries to convert existing gas burners to substitute fuels, and those now using gas, to install standby equipment for the use of substitute fuels during critical periods. It makes recommendations to the War Production Board as to the necessity of installing new gas burners in new or expanded industries. It encourages users of gas for space heating purposes to convert their equipment to substitute fuels.

The gas industry has cooperated very splendidly with the program. In fact, the various units have been staffed for the most part with engineers loaned to the Ordnance Department for the duration of the war. The Technical Staff of the Detroit Unit consists of three men from the Michigan Consolidated Gas Company and one from Consumers Power Company. This has resulted in an intelligent approach to the fuel problems and has built up confidence among contractors and suppliers.

Oil Replacement Program

The oil situation has become very critical and it is the opinion of the War Production Board and the Office of the Petroleum Administration for War that the available oil supplies should be reserved for those operations where less critical fuels are not suitable. Consequently, a concerted effort, in which the Ordnance Department concurs, is being made to convert space heating, water heating and steam generation from oil wherever feasible. In this program consideration must be given to the amounts of critical material necessary for such conversion. In some cases, conversion to natural gas can be made easily and economically.

The question of standby for natural gas of various fuels has engaged the attention of all of those concerned with the continuity of production. It may be said that insofar as the Detroit Ordnance District is concerned, natural gas supplies are at present adequate, except during periods of severe weather. For some metallurgical operations, oil is not a suitable standby. The installation of liquefied petroleum gas necessitates the utilization of equipment which requires the use of a large amount of critical material. For these reasons, the installation of standby equipment is not always justified, particularly if production lost through a curtailment of gas supplies can be made up by subsequent intensified operations or if a bank of material can be maintained. When shortages of natural gas supplies occur, the Limitation Order as amended outlines a satisfactory procedure. Interruptible customers are first curtailed; and it is, therefore, essential that these consumers maintain adequate standby if they are engaged in essential war work.

I wish to take this opportunity, in behalf of the Detroit Ordnance District, to thank the utilities and ordnance contractors in this area for their splendid cooperation in maintaining uninterrupted production and in conserving critical fuels for essential uses.

Presented before A. G. A. War Conference on Industrial and Commercial Gas, Detroit, Mich., March 11-12, 1943.

Equipment Progress . . . *Twenty Years of Industrial Gas Research and Development*

E. G. de Coriolis

From an emergency fuel in World War I, industrial gas has emerged as an indispensable factor in the production of countless war products—a development which will inevitably affect post-war industry. It is an amazing story of fuel utilization in well-designed equipment resulting from years of research and persistent individual effort.

By E. G. de Coriolis

Research Director, Surface Combustion, Toledo, Ohio

SOME twenty years ago, a group of men gathered at what was destined to be an epoch-making meeting. To be exact, the date was June 6, 1923, the meeting place New York and these men, thirty-six in all, met to lay the ground work for the formation of the Industrial Gas Section of the American Gas Association.

Twenty-Year Program

That same year at Atlantic City, the newly formed Industrial Gas Section held its first independent meetings and organized its own affairs. The keynote of these meetings was that gas had to be sold to industry and this had to be accomplished by the very men who were then present. We can now say, without fear of contradiction, that the continued sales effort of these past twenty years has achieved its results, and that it has culminated in the definite acceptance by industry as a whole of gas as the preferred fuel for all heating operations.

In looking over the roster of that 1923 meeting the striking fact is that it comprised mostly the men who were then, and many still are now, carrying the brunt of the battle. They are the men who have carried on the work during these eventful years and to them we are largely indebted for what has been accomplished. And let it be said to the younger men who have since joined the ranks: the job was not an easy one. At times it seemed indeed that obstacles were insurmountable. Let us see what these men faced in the year 1923 when they met to do something about it.

The first thing these men realized was that they had to have more and better equipment if they were to do their job. There was ample gas manufacturing capacity and generally speaking distribution was adequate. But the equipment was sadly lacking both as to quality and diversity. Let us see what took place during the European War. In one instance, a manufacturing plant on war production secured permission to close off a city street by throwing a shed over it. Beneath the pavement was a gas main. Outlets were run into improvised forge furnaces and gas went to work. When the war ended the shed was torn down, the forges discarded and the street restored to its former use. Gas had done its job as an emergency fuel but for peace-time forging fuel oil remained the preferred fuel. Many instances of a somewhat similar nature could be told if some of the older heads of the gas industry could foregather and reminisce on their experiences.

If gas could be sold as an emergency fuel, why could it not be sold as a permanently usable source of heat for industrial operations? It was realized early that selling gas *per se* was not the answer. It had to be sold not as a product but as a result. In other words, fuel and equipment had to be presented in a combination capable of producing a result which would be acceptable to industry. There was but one way of reaching the goal: it had to be along the path of research. In order to develop suitable equipment, the conditions under which it had to function had first to be studied, the effects made known beforehand and the fundamentals established upon which a true structure could be built. And one of the most important elements of that structure involved the early recognition that eventual success had to be based upon the close cooperation of the utilities and the gas equipment manufacturers. Some one had to incorporate the findings of research into a piece of equipment and to carry the responsibility for its proper functioning in the plant of the eventual user, the arbiter of its final success: the customer.

A. G. A. Research Leadership

The story of that effort has oft been told. The procedures followed, the experimental work conducted, the many discoveries made have formed the burden of many interesting and instructive reports which have been widely disseminated. But how many realize the true significance of the results achieved? One of the most epoch-making researches of all time was the quest by Columbus for a new

Presented before A. G. A. War Conference on Industrial and Commercial Gas, Detroit, Mich., March 11-12, 1943.

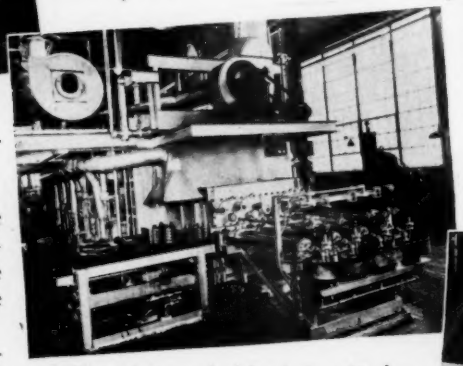
route to the Indies. He too sallied forth into the unknown to find something, guided by sound principles, those of navigation in his case. He did find something, not the East but the West Indies and he found something of even greater importance: he discovered America. And since his time many others have set forth on research of many kinds only to find that the most important objective achieved was not the one originally contemplated. And so it may be stated in the case of the industrial research undertaken by the American Gas Association. Some important technical facts have been brought to light which have been of considerable value in advancing the use of fuel gas in industry. But the indirect

Rotary hearth billet gas-fired heating furnace used in shell production

effect of this enterprise has been the establishment of gas-equipment manufacturers on a basis which some hoped for but hardly expected to see realized in their life time.

Examination of the research projects conducted by the A. G. A. will reveal that in the course of improving the application of gas to forging there was developed a new process of burning gas by diffusion combustion. This process comprises laminating the flow of streams of fuel gas and air in the proper proportion for complete combustion while maintaining these fluids within an enclosure in a non-turbulent stream. When so maintained, there is no admixture of the gas with the air but instead combustion proceeds by interdiffusion and is maintained at the boundaries of the respective streams. A by-product of this method of combustion is that the hydrocarbons in fuel gas are cracked with the evolution of carbon clouds which become highly luminous and radiant. When such flames are passed over a layer of work on the hearth of a furnace, heat is imparted almost wholly by radiation with resultant rapid heating.

Diffusion combustion as such did not prove successful in its application to forging. The reason for this was due to the limitations this method of combustion imposed upon the forging operation. The furnaces had to embody complete closures and the work had to be quite uniform in section and present no obstruction to the path of the flames. Otherwise the flames were "spilled," that is: the streams were broken, turbulence set in and the effects of diffusion were lost. The lessons learned however did indicate a direction in which some of these effects could be applied to forging. It had been previously known that fuel gas when burned in premixed combustion produced a thin but very tenacious scale on the work. When burned by partial diffusion, that is,



Radiant tube gas carburizing furnace (pusher tray type) used in carburizing gears for automotive war equipment, including tanks, half-tracks, jeeps and trucks

with a turbulent but luminous flame, the scale tended to be heavier but became quite loose, a characteristic which was highly important for successful forging.

Applications of this type are now rendering very effective service in an important branch of the munitions industry: forging billets for high explosive shells. Control of scale conditions, while maintaining the highest possible temperature in the billet, has proven most successful. As it comes from the furnace the billet is passed through a scale breaker and the quality of heating is judged by the ease and completeness with which the scale is removed. After extrusion or pressing, the rough shell is examined for imbedded scale, and if conditions are not properly maintained, rejections by inspectors mount up rapidly. These shells receive no cleaning before they enter the machine shop and if scale remains imbedded the tool life on the turning lathes becomes very short and production of shells falls off rapidly.

A type of furnace embodying this application is a rotary hearth furnace with a multiplicity of burners firing along its periphery. These burners have a device by which the flame can be varied from premixed to luminous while maintaining the same proportions of air to gas for combustion, and these proportions are similarly held from full capacity down to very low rates of turn-down. In addition, the furnace is equipped with automatic damper control which can be so adjusted that air intrusion is excluded even with frequent openings of the charge and discharge doors. There are also two zones of temperature control which are adjusted so that a

Close-up of gas radiant tube carburizing furnace showing radiant tube eductors on side of furnace

blanket of flame is held over the work in the discharge zone.

This is a far cry from the forging operation previously described during the European War when a gas pipe was pushed up through the street

pavement into a pile of brick. It is an illustration of what research has done in making possible one of the most difficult applications of fuel gas to an industrial heating operation. It is the direct fruit of this research. It might be compared with the discovery of the West instead of the East Indies, but a worthwhile discovery nevertheless. The most important discovery lay beyond.

The indirect product of this research is that it led to the development of the radiant tube. It had long been known that gas could be burned inside a tube to heat its walls. The methods of application were, however, quite unsatisfactory. Distribution of heat along the tube length was most uneven and heat output per square foot of tube area was very low. Furthermore, all previous applications required that combustion of the gases within the tube be under pressure. By adopting the principles of diffusion combustion these conditions were reversed. Since the streams of air and gas were now separated, whereas before they were intimately mixed, it became possible to allow the gas to flow freely into the tube at one end and cause the air from the surrounding atmosphere to enter the tube at the same end by the simple expedient of placing the tube under suction.

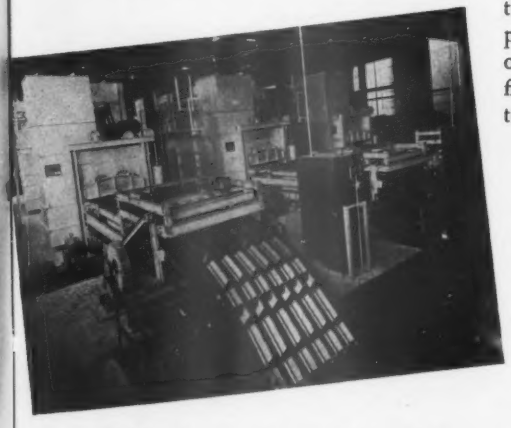
This accomplished several results. It greatly simplified the introduction of air and gas in non-turbulent flow. It facilitated ignition by having the entering end of the gas stream readily accessible. Since combustion proceeded progressively it made possible greater flows of gas thus increasing heat output. By streamlining the flame hot spots were eliminated and a greater temperature uniformity throughout the length of the tube was achieved.

And finally, by having the combustible and air under negative pressure throughout the tube length it insured that, in the course of time as cracks would begin to develop on the tube wall, no outward leakage of flue gases could occur. But above all else, and what guaranteed beforehand long life of the metallic tube, was the fact that the air stream was maintained at the tube wall while the burning gas was held in the center, away from the tube surface, and imparted its heat to the wall mainly by radiation. Hence the name: "Radiant Tube."

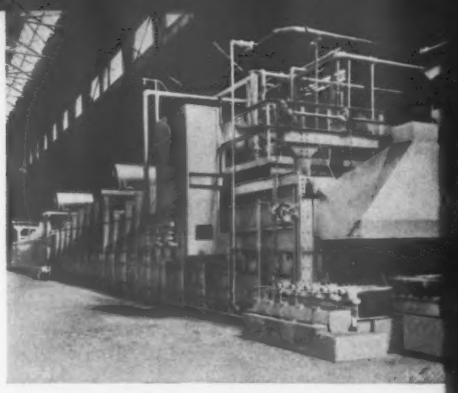
Application to Controlled Atmosphere Furnaces

The development of this method of combustion has had far reaching effects on the utilization of industrial gas. And it came opportunely at a time when the control of furnace atmospheres was beginning to spread itself to more and more heat treating operations. By divorcing the source of heat from the furnace atmosphere, large avenues were opened to the equipment manufacturer in branching out into many fields of application. Possibly one of the most outstanding is the radiant tube gas carburizing furnace.

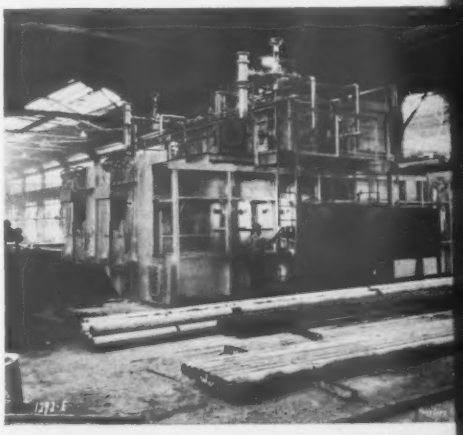
Carburizing by gas in retorts had been in use for many years. Its applications, however, were limited. When the continuous muffle furnace appeared on the scene it immediately opened up greater possibilities in this field. But the alloy muffle was a deterrent to universal adoption of the process due to the uncertainty of its life and the difficulty in replacing it. Muffle failure during the peak of an automotive year was capable of causing serious set-backs to production. The radiant tube overcame all these difficulties. It made possible the construction of large capacity furnaces, operating on multiple cycles and mechanized to the point where some of these installations became veritable heat-treating and processing machines.



Walking beam gas furnace unit for hardening, quenching and drawing of shells



Continuous type gas forced convection furnace for modern armor plate



Large gas-fired convection furnace doing vital war work—also a recent development

Radiant tube roller hearth bright annealing furnace for aircraft tubing manufacture

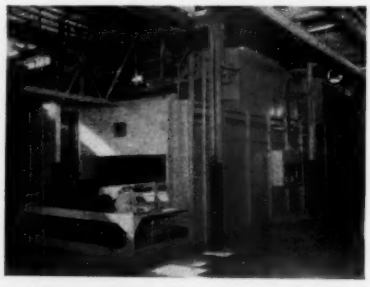
Battery of forced convection gas furnaces used in process annealing of cartridge cases

In one of these continuous furnaces the work is first carburized, then quenched on the supporting trays within a hood so that it is not exposed to the atmosphere. In emerging from the quench tank the oil is drained off, then the work is progressively washed, tempered and cooled; after which it is removed manually while the trays enter a burn-off oven prior to returning to the charge end, thus terminating a complete loop through the equipment. One operator loads the work, which comprises a great variety of gears that are loaded on individual fixtures. Another operator unloads the finished work. The remainder of the operation is entirely automatic. A very large percentage of the gears for automotive war equipment is carburized in this type of equipment, and this includes trucks, half tracks, jeeps and tanks.

Seamless Tubes for Aircraft

Many hours could be spent in describing the considerable number of war applications in which the combination of radiant tubes and prepared atmospheres are playing an important part. One particular and very recent development deserves special mention. It is the prepared atmosphere quench. In the heat-treatment of seamless tubes it had been the practice to anneal the tubing in the process of drawing it down to finished size. The earlier steps were usually carried out in direct-fired furnaces followed by pickling. As the tubes become smaller in diameter and more elongated, the annealing would take place in controlled atmosphere furnaces in order to better control the character of the metal surface for subsequent drawing. When finished to size, the tubes were usually freed from drawing compound and bright normalized in radiant tube roller hearth furnaces with elongated cooling zones. Seamless tubes becoming an important component of aircraft, with required close metallurgical specifications, it was found necessary to control the cooling rate by slightly hastening it as the tube left the furnace and entered the cooling zone. This was achieved by the addition of a fan to agitate the atmosphere within the cooling zone.

More recently, new methods have come into use in producing the tubing by welding from a strip. This type of aircraft tubing is much more difficult to heat-treat and will fail to meet specifications if processed through furnaces designed for seamless tubes. It was necessary to develop a radically different method of cooling. Powerful fans, one above and one below the level of the roller conveyor in the cooling zone now circulate the prepared atmosphere through refrigerator coils and the cold atmosphere strikes the tubes, top and bottom, at cyclonic speeds resulting in a veritable quench. About fifty per cent of the tube heat imparted into the tube as it travels through fifty-five feet of furnace is absorbed by the atmosphere in the first four feet of the quenching zone.



Mesh conveyor recirculating air draw furnace

In terms of time this is equivalent to reducing the tube temperature down to black heat in thirty seconds. Meanwhile, since the furnace inlet and the cooling zone outlet are open to allow for constant ingress and egress of the tubing, it is necessary to so delicately balance this internal cyclone that air does not intrude at either end, the while the flow of atmosphere gas steadily exudes at these openings and burns with a steady blue flame. By controlling this "gaseous quench" the physicals of the treated tubes may be made to conform to exact specifications.

Growth of Convection Heat

Another field in which industrial gas has played an important part is in the utilizations of the forced convection furnace. The air-draw furnace of the tool room and small production shop has been a familiar piece of equipment for several years. But the application of convection heating on a large scale has been almost wholly a war development.

Generally one is inclined to limit refinements in heat-treating to the tool room and automotive plants. In more recent years the non-ferrous industry: copper, brass and aluminum, has made increasing use of convection heating for its various processes, particularly where close control of grain size was found necessary. But it remained for the present war effort to demonstrate its effectiveness in the heat-treatment of armor plate.

Here is an ancient art which had depended solely upon human skill in performing a heating operation fully as delicate as that of any tool room process. Plates over thirty feet in length and weighing a great many tons have to be heated at temperatures which differ from one end to the other. This is due to the composition of the steel which cannot be made uniform lengthwise. And differences of 10° F. have to be within the control of the operator. Heretofore, this had been attempted by having a great many thermocouples welded to the underside of the plates and firing overhead by hand controlled burners. And only a single plate could be heated in the furnace at any one time although in terms of capacity these furnaces could have held many times the tonnage.

Revolutionary Heat Application

The adoption of convection heating has revolutionized this process. Plates are now heat-treated accurately, still maintaining a different temperature from one end to the other. The control is accomplished by predetermined and automatic means as directed from the laboratory. And of no less importance from a production viewpoint is that several plates can now be charged simultaneously, thus considerably increasing tonnage output.

Accuracy of heat-treatment can be further illustrated by the notable performance of furnaces for high explosive shell. Some time before Pearl Harbor one of the arsenals had been working on the development of methods which would produce shell of high physicals with constancy and

uniformity. They realized then that whenever an emergency would occur they would have to be prepared to produce shell in a great number of plants unaccustomed to refined heat-treatment. The equipment to be selected, therefore, had to be of a type capable of operating automatically, beyond the control of shift operators, and so timed as to produce a high degree of uniformity regardless of the flow of work to the furnace.

The steps in realizing this objective included the adoption of the alloy walking beam as a furnace mechanism which was capable of accurate timing coupled with absolute uniform heating of the shell, whether it came singly or in scores to the furnace loading forehearth. The furnace was burnered with a wide range of turndown capable of taking any load within its capacity and maintaining the same rapid rate of heating of the shell. Tied in with the walking beam mechanism was an internal jet quenching device which hit the inner base of the shell with a powerful jet, this at the point of maximum strain of the projectile and where rapid quenching was most desired. The thoroughly quenched shell then entered a convection heated draw furnace where the same quality of heating and constancy of motion was maintained by another synchronized walking beam. All these component parts operated as a single mechanism.

Stellar War Performance

When the crucial test came this highly refined gas-fired equipment more than vindicated the confidence of the arsenal's foresight. When, suddenly, after shell manufacturing plants had already got into war-time production, it was found necessary to change the steel, which now made it mandatory to heat-treat all shell, this equipment was ready to perform. It carried into those plants, which heretofore had had no experience in the heat-treatment of shell, the same degree of accuracy which had been developed by the arsenal during the previous peace-time period.

When convection was applied to the tempering step considerable improvement resulted. The complete operation of hardening, quenching and tempering was also greatly facilitated by the adoption of the alloy walking beam in both furnaces and the mechanized internal quench tied in with the motion of the beams. All these refinements brought about unit heat-treatment in the sense that the flow of shell could be varied from full furnace to practically no flow without affecting the quality of any shell going through. This peace-time development became of extreme importance when it was decided to swing the total production to full heat-treated shell. Many plants that had had no previous experience in heat-treatment were able to enter the field for this type of shell with a notable record of performance due to the reliability and constancy of the method and equipment adopted for this process.

This brief review of industrial gas would not be complete without mention of its successful application in the production of metallic magnesium. Much has been written regarding the production of magnesium from sea water and this extraction process well deserves the encomiums which it has received from scientist and layman alike. There is something quite magical about the hand of science lifting the fleeting airplane from the depths of the placid sea. But just as practical, if more prosaic, is the process of extracting magnesium from dolomite by the ferrosilicon process. Calcined and pulverized dolomite mixed with powdered ferrosilicon is briquetted and the briquettes retorted under high vacuum resulting in the distillation of vapors of magnesium which condense in a high state of purity at the mouth of the retort.

The chief difficulty in carrying out this process on a large scale is that the only suitable retort available is made of heat-resisting alloy which has a softening point not far removed from the required operating temperature of 2150° F. Under the stress of high vacuum and high temperature these retorts collapse in a comparatively short time. Nevertheless, at a time when magnesium had to be produced in large quantity there was no alternative but to go ahead with

(Continued on page 175)

After the War

(From Prime Minister Churchill's worldwide broadcast, March 21)

Striking advances are open for both gas and electricity as the servants of industry, agriculture and the cottage home.

Vitamin Game Teaches Nutrition Principles

Demonstration of a clever game called "Vita-Min-Go," designed to teach balanced nutrition, is given by Florence Matheny, home service director of San Gabriel Valley district. Southern Counties Gas Company. The player is Commercial Agent R. E. Honey. The game is played by placing markers on the various sections, indicating "vitamin score" for the food eaten in a single day, and it is used by the home service department as part of a "Nutrition in Industry" program

A striking field kitchen operated by the British Columbia Electric Power & Gas Co., Vancouver. Two members of the home service staff are in constant attendance to give information on the preparation of nutritious meals from the rationed food supply. The display emphasis is on better lunchbox meals for war plant workers

Training for Sub-zero Service Problems

ANY distribution department employee will agree that sub-zero weather brings forth service problems which are not experienced when old man Mercury finds a higher spot on the thermometer. Accordingly, schools known to the distribution department workmen as "No Gas" Schools are held at the three district shops of The Peoples Gas Light & Coke Co., Chicago, at this time of the year to demonstrate new techniques to employees who deal with sub-zero service problems and to acquaint new men with the various "stoppage" conditions to be found in parts of the gas system on extremely cold days, and show how they can be alleviated.

Each school is equipped with a large wooden panel, mounted on rollers, which duplicates the piping layout to be found in the various homes. The instructor lectures on the fundamentals of trouble shooting, and then allows the men to test themselves with assignments on the panel. They are graded for their work as in any other school.

Among the points covered in the school are: the location of drip pots, where water in the system collects to be later pumped out in case of stoppage; the accepted method of eliminating frost from pipes; removing rust from the system; checking the piping for kinked connections or obstructions; checking the gas cocks to discover if they are full on; and the proper adjustment of appliances. The men are also taught the proper use of the tools and implements carried in the gas man's repair kit, as well as such special equipment as the vacuum tank and the pressure blower.

The classes were opened about January 15, and continued, except for interruptions due to cold weather when the men were required in the street, until February 5. The average class accommodated about seven men at a time. Instructors in the schools were: Arthur H. Slinn, South District, John Hanson, Central District, and Arnold Menet, North District.—*Gas News.*

A. G. A. News Bulletin to Service Men

LEAVENED with good humor and spicy bits of gossip about their former associates as well as legitimate news of their fellow service men and some serious business notes, the news bulletin for American Gas Association Testing Laboratories' employees in the Armed Forces is a most unique publication. The second number issued in March contained nine mimeographed pages of plain and fancy items about the folks at home and the boys abroad together with a letter from R. M. Conner, director of the Laboratories, and a reprint of the article "With Our A. G. A. Laboratories' Men in the Armed Forces," from the February A. G. A. MONTHLY.

Designed to encourage correspondence to the boys in the service and to maintain contact with them throughout the war, this publication could well serve as a model for gas companies who wish to keep in touch with their former employees. It contains a special department where interesting excerpts from letters give odd bits of information on the "Lab's own" service men in many parts of the world.

As a sample of the vein of writing, the following opening "verse" is typical:

"Hello, and greetings to you guys
Far off on distant shore,
Our newshawks heard your pleading cries
For scandal—'more and more.'
Since rationing—gas, tires, and tea,
Are really hard to get,
But dirt about our coterie,
It ain't been rationed yet."

Hats off to Chief Editors Krause and Zare for a fine job.

Gas Drilling Barred in Texas Panhandle

AN order prohibiting the drilling of new natural gas wells in the Texas Panhandle has been issued by Petroleum Administrator Harold L. Ickes. It specifically prohibits use of any materials to drill, complete or provide additions to any well in any discovered or undiscovered natural gas field in Carson, Collingsworth, Gray, Hansfield, Hartley, Hutchinson, Moore, Potter, Sherman or Wheeler Counties.

Deputy Petroleum Administrator Ralph K. Davies said the order would hold until additional facilities for carrying natural gas to consumers become available. "Over 1700 wells now are producing gas in the Texas Panhandle field," he said, "and they are keeping available natural gas pipe lines loaded to capacity."

"S. G. A. Progress" to Appear Bi-Monthly

THE publication *S. G. A. Progress,* official organ of the Southern Gas Association, is being enlarged in scope and will be published bi-monthly according to an announcement by Frank C. Smith, president, Houston Natural Gas Corp., and president of the Association.

This action was taken to increase the service of the organization to its members and to compensate in part for the fact that no annual convention is to be held this year. An editorial board composed of 12 members will be responsible for contributions on different phases of the gas industry. L. L. Baxter, secretary-treasurer of the Southern group, will continue to act as editor.

Gas in Czechoslovakia

THE *Neue Tag* (Prague) writes: "The regulated consumption of gas in Prague has up to now proved successful and therefore the gasworks will, by way of experiment, permit the use of gas the whole day. If the population does not maintain discipline, the restriction on gas will again be enforced." It is to be noted that once before the restrictions were lifted, but had to be reenforced.

Comfort In Business . . . *Air Conditioning Small Commercial Establishments with Gas*

By GEORGE ELMER MAY*

Utilization Engineer, New Orleans Public Service Inc., New Orleans, La.

THE utilization of gas for year-'round air conditioning has grown steadily during the past several years and has attracted much interest within the industry. Many papers have been written on progress in applying small year-round conditioners to the residential field, but little has been said about the interesting commercial market for such equipment. Over fifty per cent of the experience in the south was had with the commercial field. The studies and observations in connection with these experiences should form a substantial and valuable background for post-war planning on the part of those who will actively promote gas all-year air conditioning when peace is ours once again.

Although the experience and observations presented herein are confined to the territories served by New Orleans Public Service Inc. and United Gas Corporation, they are representative of many other sections of the country. This paper is written in the spirit of sharing with others some of the more important things that have been learned in connection with air conditioning commercial establishments with gas.

Development of Small Equipment

During the past three years, twenty-seven gas utilities have made hundreds of gas air conditioning installations throughout this country. Reports from all sections support experience in the south and indicate that the equipment gives a good account of itself. In the southern areas served by United Gas Corporation and New Orleans Public Service Inc., 103 out of a total of 166 units were installed in commercial establishments; which installations represent in excess of 200 unit-years of satisfactory experiences. There is ample proof that the equipment is proved and acceptable.

Presented before A. G. A. War Conference on Industrial and Commercial Gas, Detroit, Mich., March 11-12, 1943.

* Chairman, A. G. A. Technical Advisory Committee on Gas Summer Air Conditioning Research.

Character of Market

The commercial market for gas air conditioning has interesting characteristics quite different from other fields. In fact, it is almost unique.

Here is a market *already* developed by the electric industry where appreciation of need and value of air conditioning is well established, and where one sale practically forces another. In this market, investment cost and operating expenses are not considered luxuries, but are classed as normal business necessities. The salesman emphasizes particular type of equipment being offered and confines his attention to showing commercial prospects how the place may be conditioned and the advantages his system has over other methods.

Analysis of Market

Consideration will be given first to *where* the equipment has and can be installed, and second to *what extent* the commercial market may reasonably be expected to expand in the future.

Installations have been made in nearly every one of the following classes of establishments:

1. Apartments
2. Banks (small)
3. Clubs (sections)
4. Clinics
5. Offices
   - Professional
   - Private
   - General
6. Shops
   - Apparel
   - Barber
   - Beauty
   - Book
   - Fur
   - Sandwich
7. Stores
   - Candy
   - Drug
   - Grocery
   - Jewelry
   - Hosiery
   - Shoe
   - Sporting goods
   - Broadcasting
8. Studios
   - Art
9. Special
   - Research

In general, the commercial market under consideration comprises all establishments with relatively small heat loads from people and moisture. This eliminates funeral parlors, restaurants, and cafeterias as suitable applications for small gas air conditioning equipment of present design.

It is very encouraging to learn of the past growth in acceptance of gas air conditioning in commercial establishments and at this time many plans are being made for the future of such equipment.

Certain definite trends have been established for commercial acceptance of air conditioning by the electric industry and furnishes an interesting base for predicting future growth of gas air conditioning. Figure 1 indicates growth of electric air conditioning since 1933, expressed in terms of installed capacity. While these data are for New Orleans only, it generally is representative of the rate of growth elsewhere. Assuming no further growth during the war, it is reasonable to expect a sharp increase for the first several years following the war's end, so that at year X + 2, the rate of increase will probably exceed that prior to December 7, 1941.

It is expected that this growth will be further accentuated by the need for replacement of worn out and obsolete electric equipment, and there gas should have many natural advantages.

Of course, the actual business secured for gas equipment will depend upon how well the industry sells the advantages of gas and will be directly proportional to such efforts.

It is an interesting and significant fact that over 50% of the gas air conditioning installations made in New Orleans and United Gas Corporation territories are in commercial establishments although all sales promotional

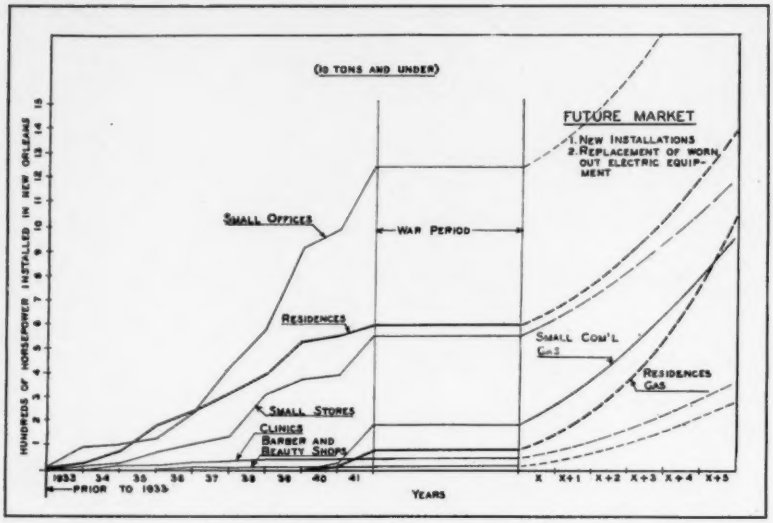


Figure 1—Acceptance of air conditioning in New Orleans by class as indicated by growth in refrigeration capacity installed

efforts were directed at the residential field. Since this is true, it is reasonable to assume that a much greater volume of commercial business could be had with a well-directed sales program.

Characteristics of Systems

Design and installation of a commercial air conditioning system is relatively simple compared with other types. This is a result of many factors, the more important of which will be mentioned herein. As a result, commercial installation costs are lower than others, expressed both in terms of cost per sale and system cost.

Psychrometric requirements are not too exacting so that the control elements are reduced to a very minimum. With frequently opened doors and the great variance in ideas of comfort between employee and customers, no fine control over temperature or humidity is justifiable.

Particularly in small stores, offices, etc., the air distribution system often consists of no more than a single supply and return grille in a back wall close to the position of the conditioner. Short ducts, with a minimum of insulation, involving simple design, effect a minimum in cost of materials and labor. Then, too, the location of the conditioner is often the site of adequate water, electric and gas services, so that a minimum in plumbing and wiring is needed to "connect up" the unit.

Careful design of costly acoustic treatment is seldom required because of normal high background noise levels generally found in commercial establishments. Likewise, since appearance is not of prime consideration, exposed duct work is often acceptable and expensive decorating seldom required.

All of these items have a favorable effect on investment cost, more clearly seen by examining the figures below which compare cost of commercial with residential installations.

INVESTMENT COST COMPARISON

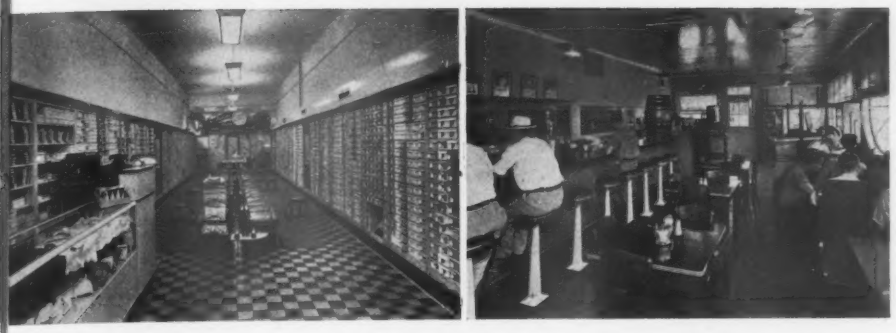
	Residential	Commercial
No. of Installations	12	13
Investment Cost per Ton	$462	$378

Another interesting characteristic of many commercial systems is that their operating time and cost are not greatly influenced by the weather, such as in the case of a residence. Figure 2 shows operating costs for a drug store, shoe store and a general office, contrasted with a residence. Note the flat curve indicating more constant use in case of the shoe store, which is least affected by the weather, and the sharp peak in residential use—a more direct influence of weather.

In all cases, however, it should be emphasized that the maximum gas use occurs during summer time—off system peak, and represents increased profits from existing investment for the utility.

An interesting fact about commercial systems is that design is based upon future loads imposed by expected increased business resulting from installation of air conditioning service. In almost every other case, the

Year-'round gas air conditioner installed in barber shop at right. Note neat appearance and simple air distribution system. Short ducts connect with grilles immediately on other side of wall. The drug store has a central air distributor with ceiling outlet. Gas air conditioning has greatly improved business



Two more applications of gas air conditioning. In the shoe store the exposed ducts may be seen resting on top of wall cases—an installation which is efficient, acceptable in appearance and relatively inexpensive. The sandwich stand has a ceiling diffusing plate forming a simple and effective distributor of conditioned air

design is based on existing or known requirements.

Buying Motives and Sales Appeals

Experience in selling air conditioning to commercial establishments has taught that special, well-suited sales appeals must be used which do not apply to other markets. The buying motives which have been found most effective are listed below in their order of importance and are shown in contrast with those which are considered best suited for the residential market. The difference in character between the two groups is quite sharp and interesting.

Sales Appeals Found Most Effective

RESIDENTIAL
(Personal)

1. Comfort
2. Health
3. Cleanliness
4. Noise elimination
5. Personal efficiency
6. Privacy
7. Aid to convalescence

COMMERCIAL
(Profit)

1. Increased patronage
2. Increased sales per patron
3. Overcome seasonal slump
4. Loss reduction
5. Cleanliness
6. Advertising value
7. Prestige
8. Good will

Of even greater interest are the buying motives which have influenced selection of gas air conditioning equipment. They are summarized below, in their order of importance, according to experiences with commercial establishments in the south.

Buying Motives Influencing Selection of Gas Equipment

1. Heating and cooling from one unit
2. Simple control for seasonal changeover
3. No moving parts and long life expectancy
4. Cleanliness of gas as *one* fuel for all seasons
5. Replacing obsolete heating equipment
6. Compactness
7. Silent operation
8. Seldom requires enlargement in utility services

The owner is interested in item 8 because it saves unnecessary costs to enlarge electric, gas or water services.

The utility is particularly interested in item 8 because no further investment in service is required in order to create additional gas revenue.

Experiences With Users Before and After Purchase

Without doubt, early promotional efforts were aided greatly by the fact that the local gas utility stood behind the program and equipment. No other agency could have done as much in offsetting the public hesitancy to buy a new thing for the first time. And no other agency has had the ultimate interest or the financial capacity to see commercial gas air conditioning off to a good start. The first few installations had to almost be "given away" in order to convince the *Utility* and the *User* that the program was sound. The enthusiastic interest of the user soon radiated, influenced others to consider gas air conditioning equipment and the acceptance began to spread rapidly.

The investment cost seldom influences selection of commercial gas air conditioning, but it is a common experience to show a considerable savings in operating expenses. In the case of a large clinic, a large premium was paid in first cost because operating savings over competitive systems paid off the premium in approximately three years. On the other hand, this was not the only reason for selecting gas equipment.

Probably the most interesting and gratifying experience with users fol-

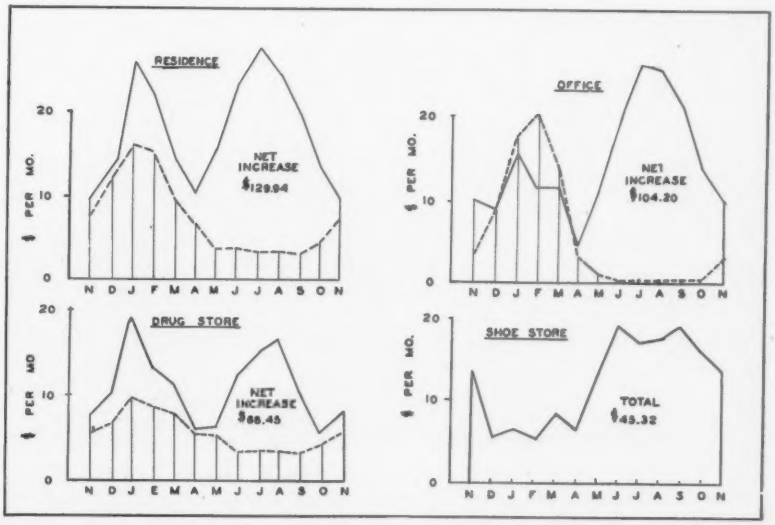


Figure 2—Operating cost data. Gas usage only

lowed purchase. Indications of satisfaction come in several forms. A great majority of the testimonials which have been received, were voluntary on the part of the owner. They were prompted by personal delight in results of purchase. These letters thanked for good service, mentioned noticeable growth in business, improved customer good will and other tangible benefits. In the case of a sandwich stand, the owner announced his intention of buying gas air conditioning equipment for each of his other stands. Still another owner states that he now wants a gas system for his home. Owners have, of their own accord, invited friends to see "their system" and thereby created new prospects. These facts certainly bespeak the disposition of satisfied users.

Conclusions

Now that practical equipment is available, a broad market for commercial air conditioning installations can be developed when the war is over.

In order to sell commercial establishments, special sales approach and appeals are required. Gas air conditioning systems offer tangible advantages over competitive equipment.

Coordinated efforts of manufacturers and utilities to maintain all installations in satisfactory operating condition will go far toward preserving user good will and will result in a fine springboard for future sales promotion.

Active utilities have increased from two to twenty-seven in approximately three years. There is every reason why *all* gas utilities should be prepared to promote this highly desirable business when the war is over. But—a great deal of post-war planning and preparation is required of those who will be ready when the green light is ours once again, so the time to start is *NOW*.

Industry Leaders Address Gas Institute Seminar

FIRSTHAND information—brought to students by experienced leaders in the gas industry—is a feature of the educational program at the Institute of Gas Technology, Chicago, in the form of a seminar orientation course on the gas industry. Begun last fall, the course features talks and discussions by members of the industry on various phases of gas technology.

The first major topic was covered by Robert B. Harper, vice-president, The People's Gas Light and Coke Company, Chicago who gave a series of three lectures on the history and development of the gas industry and illustrated his talks with several charts. Another seminar speaker was E. J. Gardner, superintendent of Blast Furnaces and Coke Plant of Inland Steel Company, who spoke on "The Coke Plant—Its Functions and Operations."

Featured speaker at two meetings was R. E. Kruger, superintendent of gas manufacturing, Rochester Gas and Electric Corp. He described plant operations and problems in the production of water gas and producer gas, and devoted some attention to techniques of mixing gases to produce city gas of constant characteristics for home consumption.

Problems in utility management and regulation are also covered in the course. N. Henry Gellert, president, Great Lakes Utilities Company, and a member of the Gas Institute Board of Trustees, gave two lectures on the Public Utility Holding Company Act.

New uses for gas is a subject which has been treated in one lecture and will receive attention in the future. Dr. E. W. Guernsey, assistant director of research, Consolidated Gas Electric Light and Power Company of Baltimore, addressed the seminar on "Manufactured Gas As a Raw Material for Synthesis."

Staff members and students also participate as speakers on the program.

Robert B. Harper, vice-president of The People's Gas Light and Coke Company, addresses Institute of Gas Technology students on the history and development of the gas industry. This talk and other similar lectures are a part of the seminar orientation course being offered at the Gas Institute

Merrill N. Davis Dies

Merrill N. Davis

MERRILL N. DAVIS, executive vice-president and secretary, Dresser Manufacturing Company, Bradford, Pa., and an outstanding leader in the gas appliance and equipment field, died March 7 at the age of 57. As second president of the Association of Gas Appliance and Equipment Manufacturers and a director of the American Gas Association, Mr. Davis had achieved a prominent and respected position in the utility field.

Following his education in Maine, Mr. Davis spent a number of years in the rubber industry, including association with B. F. Goodrich Company. In August, 1919, he became associated with the Dresser Manufacturing Company in charge of sales and advertising. In 1928, he was elected a director of that company and the following year, vice-president. In May, 1932, he was given the additional title of secretary.

Mr. Davis had been actively identified with the Association of Gas Appliance and Equipment Manufacturers since it was organized in 1935, serving as president in 1937-1938. He was also active in the American Gas Association and the American Petroleum Institute, and was a member of several regional gas and oil associations.

He was an ex-president and member of the Bradford Chamber of Commerce, a member of the Boy Scout Council of America, director of the Bradford Hospital and vice-president of the Pennsylvania State Chamber of Commerce. He was also affiliated with engineering and social clubs in New York City.

Army-Navy Award

THE Buffalo Works of the Worthington Pump and Machinery Corporation has joined the list of distinguished winners of the Army-Navy Production Award for excellence in war production. The presentation was made March 19.

Ore Reduction . . . *Use of Gas in Republic Steel's New Sponge Iron Plant*

This new plant for direct gas reduction of iron ore in addition to being an important war project opens a virgin field of gas application. Heretofore, economic and engineering difficulties have stood in the way of the development of gas as a reducing agent. This plant, as a vital yardstick for the future, merits the gas industry's close attention.

By JOHN J. CRAIG

Republic Steel Corp., Warren, Ohio

LAST Fall, the War Production Board authorized the construction of an experimental sponge iron plant to be built by the Republic Steel Corporation and financed by the Defense Plant Corporation in the amount of approximately $450,000. Design work on the plant has been carried on since that time and it is expected that construction work will start in the early part of this Spring and that the plant will be in operation a few months later. The plant will be located at the Republic Steel Corporation's steel plant at Warren, Ohio.

Sponge Iron Applications

For some months past, a controversy has been carried on in the various technical magazines of the country on the pros and cons of sponge iron. Advocates of direct reduction feel that the development of the sponge iron process will be a forward step in alleviating the present scrap shortage; in making isolated iron ore properties in the country of potential value by the establishment of sponge iron plants located at the mines; and, in general, in producing steel at lower costs than is now possible with the use of the blast furnace. Opponents of the process claim that sponge iron cannot occupy any major place in the production of steel on account of the high cost of producing it, and because of the impurities in it that must be slagged off in some type of smelting operation. They present arguments against the possible general replacement of scrap by sponge iron, pointing out that the latter represents a poor substitute for scrap, although there are some that feel that sponge iron may be of value in special applications.

Naturally, numerous factors enter into the economics of the production of sponge iron, the principal ones being the analysis and cost of the iron ore to be used; the type, composition and cost of the fuel at hand; the availability and cost of competitive scrap; and the utilization of the sponge iron, i.e., in what part of the steel-making operation can the product be advantageously used. It is to be expected that the operation of Republic's experimental plant will furnish answers to many of the present questions, and will furnish some concrete evidence as to the costs of production and the value of sponge iron to the steel industry.

Reduction Process

The proposed plant will use the Brassert-Cape low-temperature reduction process and is to have a production of 100 tons of sponge iron per 24-hour day. The ore to be used will be fine magnetite concentrates produced from Republic's low grade magnetite iron ore mines in New York state. The ore will analyze, on a dry basis, about 68.5% iron (or 94.5% iron oxide in the form of magnetite) and 5.5% gangue material, of which about one-half will be silica. The phosphorus and sulphur contents will both be low. The fuel will be coke oven gas from Republic's new coke oven plant now starting operations at Warren. The gas will contain about 56% hydrogen, will be free from tar products and will be relatively low in sulphur content.

The principal items of plant equipment include a Herreshoff roasting furnace, gas handling equipment and briquetting equipment. The Herreshoff furnace, in which the reduction of the ore takes place, is a multiple-hearth type having twelve hearths twenty feet in diameter. The gas handling equipment includes two desulphurizing units in which the incoming coke oven gas will be further desulphurized to minimize the contamination of the sponge iron product with sulphur; a heat exchanger, in which the spent furnace gases will contribute part of their sensible heat to the incoming gas; a preheater, in which the incoming gas will be further heated to the desired temperature; a gas washer, which will clean the spent gases and condense the excess water vapor present in them; a Cottrell precipitator for removing the remaining dust in the spent gas before being returned to the main gas line; and a gas storage tank. The briquetting equipment consists of a set of rolls for compressing the hot sponge iron into suitable size briquettes, and conveyors for dewatering the briquettes and discharging them into the product bins.

The ore will be charged in the top of the Herreshoff furnace and will move continuously downward through the furnace, dropping from one hearth to the next. Ore movement on each hearth will be accomplished by means of blades attached to rabble arms revolving horizontally. As the ore descends through the furnace, the moisture will be driven off and the ore heated to the desired temperature by means of the sensible heat in the uprising stream of reducing gas. On the lower hearths the iron oxide in the ore will be reduced to metallic iron by means of the hydrogen component of the reducing gas, i.e., the preheated

coke oven gas entering the bottom of the furnace. The hot sponge iron will be discharged from the bottom hearth of the furnace directly into the briquetting machine, where the material will be compressed into briquettes. This work will be done at low pressures and in a reducing gas atmosphere to prevent reoxidation of the metallic iron. The briquettes will then be quenched in water and conveyed to the product bins for shipment. The product will contain a small amount of unreduced iron oxide as it is contemplated to remove only about 90% of the oxygen present in the iron oxide in the ore.

The incoming coke oven gas from the main gas line passes through the desulphurizing units, where the sulphur will be reduced to a few grains per hundred cubic feet, and then through the heat exchanger and preheater where it will be heated to the desired temperature. This preheated gas will then enter the bottom of the Herreshoff furnace and, rising upwards through the furnace, will reduce the iron oxide to metallic iron on the lower hearths and will preheat the ore on the upper hearths. Upon leaving the top of the furnace, the spent gases will pass through the heat exchanger, the gas washer and the Cottrell precipitator and thence to the gas storage tank from which it will be returned to the main gas line leading to the steel mills, where the gas will be used for combustion purposes.

The sponge iron product, containing approximately 88.5% iron, will be shipped to the Republic Steel Corporation's steel plant at Canton, Ohio, where it will be charged as scrap to the electric furnaces. These furnaces require an appreciable tonnage of low carbon scrap free from contamination with alloys, and it is anticipated that these sponge iron briquettes will satisfactorily replace part of the normal scrap charge and thus tend to alleviate, in a small way, the present acute shortage of clean scrap.

Summarizing, this project constitutes a large scale experimental operation for the production of sponge iron and has four distinct factors in its favor: (1) a very high-grade iron ore as furnace feed, (2) a very desirable fuel in the form of coke oven gas, high in hydrogen and low in sulphur, (3) a critical shortage of desirable scrap, thus making the cost of production more of a secondary consideration, and (4) the utilization of the sponge iron product in electric melting furnaces producing a high-grade alloy-free steel that is essential in the war effort.

Gas Institute Names 17 New Fellows

SEVENTEEN students have been named to receive fellowships at the Institute of Gas Technology at Illinois Institute of Technology, Director Harold Vagtborg has announced. The 17 men will begin training for advanced degrees in gas technology. The appointees represent 14 colleges in ten states and were chosen from among nearly 150 candidates interviewed at 37 schools.

Graduates in chemistry and chemical engineering, the students will receive an annual stipend of $1135 to cover expenses during their study at the Gas Institute. During the summer they will be employed in the gas industry as a part of the required curriculum.

Dr. Lincoln R. Thiesmeyer, student counselor at the Gas Institute, reports that the 17 fellows are outstanding in scholarship, ten of them ranking first in their graduating classes. Among them, the fellows hold 49 memberships in honorary scholastic and professional organizations. Two are members of Phi Beta Kappa and two were recently elected to Sigma Xi.

The appointees are:

Rex T. Ellington, Jr., Gunnison, Colo., University of Colorado; Arthur J. Fry, Dodson, Mont., Montana State College; Richard R. Haig, Swarthmore, Pa., University of Rochester; Roger V. LeClerc, Portland, Ore., Washington State College;

Robert S. Levine, Des Moines, Ia., Iowa State College; Milton Lewis, Seattle, Wash., University of Washington; Eugene H. Luntey, Buhl, Ida., University of Idaho; Lewis H. Mahony, Jr., Denver, Colo., University of Denver; Randolph W. Mason, Hagerstown, Md., University of Rochester;

Richard F. Messing, St. Paul, Minn., University of Minnesota; Edward A. Pirsh, Ely, Minn., University of Minnesota; Walter R. Schwandt, Manchester, Ia., Iowa State University; George A. Smalley, Cascade, Ida., University of Idaho;

Chapin W. Smith, Seattle, Wash., Williams College; David J. Smith, Indianapolis, Ind., Wesleyan University; Allen N. Webb, Manhattan, Kan., Kansas State College; and John M. Woods, Wichita, Kan., University of Kansas. Final acceptances have not been received from Haig, Mason and Smith.

Salvage and Exchange Items Listed

AS a result of the January 27 request to member gas companies that they list with the American Gas Association any surplus, new or used equipment and material available for sale or exchange, the Association's Salvage and Exchange Bureau has collected more than 100 pages of such items.

Meanwhile, on February 5 the War Production Board announced that it would set up surplus materials and equipment sections in each of its twelve regional offices to expedite the transfer of material and equipment not needed by one utility to others that might require it. The operation of these sections has been further clarified with the announcement of Order U-1 as follows:

Gas companies will be required to list their unused or surplus items of material or equipment as of March 31, and quarterly thereafter, utilizing a new form which will call for brief specifications of all types of equipment within the industry. Companies will have until April 30 to file this data which will then be catalogued in Washington and sub-divided for distribution to the regional WPB offices, as an indication of items available in that region. This process is expected to take another month so that the regional offices will probably not have the program in full operation before June.

This new program of the War Production Board makes it unnecessary for the Association to continue the collection and publication of data on this subject. In the meantime, however the Association has listed and catalogued a substantial quantity of material and equipment and companies needing material are invited to communicate with headquarters which will furnish prompt information on the equipment available, its whereabouts and general specifications.

Training Manual for Fire Brigades

A TRAINING manual entitled "Industrial Fire Brigades" has just been published by the National Fire Protection Association. This manual is designed primarily for use in classes where employees are assigned to learn and practice fire-fighting duties. The many gas companies that already have a private fire brigade under a gas company fire chief will find this new manual, dated April 1943, an invaluable teaching aid. It is not designed to be a manual on plant inspection, for that is a separate field of endeavor as far as the company fire brigade is concerned.

The suggestions in this text book are consistent with those in other N.F.P.A. publications and standards which should be in possession of fire brigade chiefs—"Employee Organization for Fire Safety" (48 pages, 1942, 25¢) and "Suggestions for the

Organization, Drilling and Equipment of Private Fire Brigades" (16 pages 1937 free). These earlier books cover their topics from the organization viewpoint whereas the new manual is for the practical instruction of fire brigade members in what to do, how and when to do it.

There are sixteen chapters which serve as natural divisions for a training course. The book has 176 pages, 8½" x 11", and is printed by offset from typewritten copy. The type is large and easy to read and the many illustrations of "how to do it" clarify the reading matter still further. The book is available for $1.50 post paid from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. (Fifteen or more copies to a single address $1.00 per copy.)

William T. Ryan Dies

W. T. Ryan

WILLIAM T. RYAN 54, division manager of the Main Line division of the Philadelphia Electric Company, died Sunday, March 7, in the Abington Memorial Hospital following an emergency abdominal operation.

Mr. Ryan was graduated from the U. S. Naval Academy at Annapolis in 1913, specializing in engineering, ordnance, and navigation. As a first lieutenant in World War I, he was engaged in active convoy duty aboard a U. S. destroyer.

He entered the employ of the Counties Gas and Electric Company, now a part of the Philadelphia Electric Company system, in December, 1924, and was made division superintendent of the Main Line division in 1928. With the exception of a brief period in a like capacity in the Eastern Division at Jenkintown, he had been continually identified with the company's activities in the Main Line area, with headquarters at Ardmore.

His association memberships included the Edison Electric Institute, American Gas Association and both Pennsylvania Electric and Gas associations.

Gas in Italy

THE official *Gazette* published a Ministerial Decree, prohibiting from December 1 the manufacture, sale, hire, or transfer of gas stoves for heating purposes, and gas boilers for central heating. Spare parts for gas stoves and boilers already in use are exempted from this order, subject to available supplies. Gas stoves and boilers for public offices, hospitals and convalescent homes are also exempt.

Natural Gas Management Conference To Spotlight War Emergency

Burt R. Bay

IN accordance with the Government's war program of keeping key industrial men on the job, reducing travel on the over-burdened transportation system, and limiting discussion at meetings to vital war problems, the Natural Gas Section of the American Gas Association has replaced its annual four-day convention with a one-day management conference. Restricted to subjects of over-all industry-wide significance, the conference on April 28 at the Gibson Hotel, Cincinnati, Ohio, will include outstanding speakers from Federal agencies as well as natural gas and petroleum officials.

WPB Men to Speak

Under the leadership of Burt R. Bay, president of Northern Natural Gas Co., Omaha, Nebraska, and R. E. Wertz, president, Amarillo Gas Co., Amarillo, Texas, chairman and vice-chairman of the Natural Gas Section, respectively, who will preside, the conference program will stress subjects of immediate urgency. Important among these will be a discussion by representatives of the War Production Board and the Petroleum Administration for War of the relationship of these two agencies to the natural gas industry in its obligations to a United States at war.

Of special interest will be a description of the role of the Petroleum Industry War Council in the war effort. In this council, Petroleum Coordinator Ickes and his staff meet each month with the representatives of the oil and gas industries to clarify and coordinate the national fuel program in the interest of wartime efficiency.

The American Gas Association's war contribution will be outlined by Ernest R. Acker, of Poughkeepsie, N. Y., chairman of the Committee on War Activities. Other features include a report on the economic position of the natural gas industry, a summary of the Natural Gas Act and an address on natural gas derivatives.

Following is the program in detail:

WEDNESDAY MORNING

Opening Remarks
- A. F. Bridge, President, American Gas Association
- Alexander Forward, Managing Director, American Gas Association

Problems of the Natural Gas Industry under War Conditions
- Burt R. Bay, Chairman, Natural Gas Section, American Gas Association

Manpower in the Natural Gas Industry
- Frederick H. Harbison, Labor Counselor, Petroleum Administration for War, Washington, D. C.

The Relationship of PAW to the Natural Gas Industry
- E. Holley Poe, Director, Natural Gas and Natural Gasoline Division, Petroleum Administration for War, Washington, D. C.

The Relationship of WPB to the Natural Gas Industry
- J. A. Krug, Director, Power Division, War Production Board, Washington, D. C.

Discussion:
- L. T. Potter, Chairman, Production Committee, Natural Gas Section
- R. H. Ulrich, Chairman, Transmission Committee, Natural Gas Section
- B. C. Adams, President, Gas Service Company, Kansas City, Mo.

Business Meeting

WEDNESDAY AFTERNOON

Resume of A. G. A.'s War Activities
- Ernest R. Acker, Chairman, War Activities Committee, American Gas Association

The Natural Gas Act After Four Years
- Marshall Newcomb, Assistant General Attorney, Lone Star Gas Company, Dallas, Texas

Observations on Developments in the Natural Gas Industry During the War and Post-War Periods.
- Paul B. Coffman, vice-president, Standard & Poor's Corp., New York, N. Y.

The Future of Natural Gas and its Derivatives
- K. S. Adams, President, Phillips Petroleum Company, Bartlesville, Okla.

Arthur F. Bridge

Paul B. Coffman

E. Holley Poe

B. C. Adams

Safety Trends

Contributed by the Accident Prevention Committee
Edited by W. T. Rogers, Ebasco Services Inc., New York, N. Y.

ABSENTEEISM

SUCH words as slackers, traitors, and saboteurs are being applied to absentees as absenteeism becomes an increasingly serious problem. It is believed that many of the major causes of absenteeism in war industries, such as fatigue, poor housing and recreational facilities, over-stuffed pay checks, etc., are not prevalent in most utility companies. However, injury, sickness and other causes do account for a substantial amount of lost time which can be ill-afforded in view of manpower shortages.

In order to run down the causes of absenteeism and apply proper corrective measures, The Ohio Fuel Gas Company, Columbus, Ohio, uses a simple form, reproduced below, as a supplement to Report of Time Off. This report is made out for employees shown on the time sheet as being absent for reason other than an industrial injury.

PILOT LIGHTING

V. C. HODDICK, superintendent, gas distribution department, Rochester Gas and Electric Corp., Rochester, N. Y., has suggested a novel and safe way to light pilots on customer's equipment which his company prefers to the use of tapers. He writes:

"We have found it very inconvenient for our house heating service men to carry tapers. In place of tapers we supply our service men with a Startzit (pick up and screw starting tool). This tool was manufactured for the purpose of starting screws and bolts in places where it is difficult or impossible to hold them by hand.

"We not only use this handy tool for the purpose for which it was originally manufactured but also in place of a taper by inserting a safety match in its claw.

"This tool is 12½ inches long and was purchased from the Western Auto Supply Company in Rochester. Cannot supply the name of manufacturer as carton or tool has no identification marks. See sketch below."

Pick-up starting tool

PROPER USE OF EQUIPMENT

AN employee was using a 3-section extension ladder when, without warning the sides of the middle section failed, causing him to drop 20 feet to the ground. He was *not* seriously injured because *he obeyed instructions* by securely lashing the top of the ladder and also by securely lashing the lowering rope to the bottom ladder section.

Following are some safety rules applicable to the use of ladders:

1. Never use a defective ladder.
2. Always secure a ladder with rope at top and bottom when practicable.
3. Always secure the loose end of extension ladder lowering rope to bottom section.
4. Never place a ladder against a window sash, or against any machinery or equipment that is moving or which might be moved.
5. Always "lean" a ladder so that the distance from the vertical to the bottom support is equal to at least ¼ the length of the ladder.
6. Don't overreach (move ladder if necessary).
7. Don't move or transport an extension ladder unless it is completely collapsed (when it is less top-heavy).
8. Don't carry tools or equipment up or down a ladder (use hand line).
9. Always use a ladder that is provided with approved safety feet. When ladder is used on round surfaces, corners of buildings, etc., the ladder must be equipped with an approved "pole hugger."
10. Always "face" a ladder when climbing or descending.
11. Never "slide down" a ladder.
12. Never leave ladder standing unattended.
13. Turn in "for repair" any ladder in need of maintenance.
14. "Tag" a defective ladder. (Specify where the defect is located.)
15. Always "turn in" for complete inspection and overhaul any ladder known to have received a "blow" or abnormal "strain."
16. Use a safety belt *only* on a secured ladder. When using a safety belt place it around both sides in figure "8" fashion.
17. In climbing or descending ladders, grip sides *firmly* with both *hands*, and place foot squarely on next rung before transferring full weight of the body to the leg and foot.
18. Don't "run" up or down a ladder.
19. Look before alighting from the lowest rung.
20. In inclement weather, especially, remember that wet, icy, or oily footwear is more "slippery."

C 4A

SUPPLEMENT TO **REPORT OF TIME OFF** - DETAIL OF CODE ON FORM C4
(DO NOT REPORT TIME OFF BECAUSE OF COMPANY INDUSTRIAL INJURY)
(ATTACH TO FORM C4 A SEPARATE REPORT FOR EACH EMPLOYE WITH TIME OFF)
(DO NOT REPORT TIME OFF FOR LESS THAN ONE FULL DAY)

_____, Ohio_____, 194__

Name of employe_____Sex____Age____Married____Single____

Period: 1st to 15th No. of working days off____
Month of_____ " 16th to 31st " " " " "____

ABSENT FROM WORK DUE TO:

PERSONAL ILLNESS:
Sickness Kind:
Common Cold_____
Flu or Grippe_____
Pneumonia_____
Operation for_____
Other (explain)_____
Additional information_____

NON-occupational (off the job) injury, Kind:
None_____
Moto. Vehicle_____
Public_____
Recreational_____
Other (explain)_____
Additional information_____
Part of body injured_____

ILLNESS OR DEATH IN IMMEDIATE FAMILY_____
(VACATION - do not report on this form)
OTHER TIME OFF, Why? Such as lay off, etc._____

Signed_____Department_____Location_____

EYE INJURED

EMPLOYEE was assisting in mixing concrete for transformer foundation. In pouring cement into the mixer, cement was blown into his eye causing inflamation and three days loss of time. A strong wind was blowing from the South and the concrete mixer was spotted so that employees had to stand on north side of mixer to pour in the ingredients. Proper planning would have demanded turning the mixer around so that employees would have been on the windward side.

New England Gas Meeting Accents War Demands

REMARKABLE evidence of the ability of New England gas companies to adapt themselves to the demands of war was presented at the seventeenth annual business conference of the New England Gas Association March 18 at the Hotel Statler, Boston, Mass. An enthusiastic audience of more than 350 heard this evidence which was contained in addresses of national utility and manufacturer leaders, federal government officials and New England gas men alike.

Norman B. Bertolette, president, The Hartford Gas Company, was elected president of the Association for the 1943-1944 term. Other new officers are: first vice-president—Hall M. Henry, Negea Service Corp., Cambridge; second vice-president—David S. Reynolds, vice-president and chief engineer, Boston Consolidated Gas Co.; treasurer—Earl H. Eacker, vice-president, Boston Consolidated Gas Co.; clerk—Clark Belden, executive secretary, The New England Gas Association, Boston (re-elected).

Officers of the New England Gas Association. Left to right, seated—Hall M. Henry, Cambridge, first vice-president; John West, Worcester, past president; and N. B. Bertolette, Hartford, president. Standing—D. S. Reynolds, Boston, second vice-president; Clark Belden, Boston, executive secretary; and E. H. Eacker, Boston, treasurer

Gas Service During War

In his acceptance remarks, Mr. Bertolette spoke of the many changes from the days of normal operations, such as governmental regulations, sales restrictions, material and manpower shortages, and added: "We have met the impact of the most severe winter in our history, coupled with range and furnace oil shortages; and then the necessary endeavors for residential customer conservation of gas use as we all became faced with the possible gas enrichment oil shortages." He stated his belief that the high type of gas service being supplied during this critical war period would be of inestimable post-war value, and concluded with a rededication of the New England companies to the task of winning the war.

Giving point to Mr. Bertolette's remarks, Alexander Macomber, director, Manufactured Gas Division, Office of War Utilities, WPB, Washington, D. C., said that the winter had shown the value of having reserve oil in storage and expressed the hope that a reserve supply could be built up during the summer. He stated that the proposal of the Petroleum Administration for War to substitute gasoline for fuel oil in the water gas enrichment process on the Atlantic seaboard had been deferred because of the difficulty of securing adequate supplies of gasoline for that purpose. Mr. Macomber requested, however, that gas companies in this area should continue to compile data already requested by the government.

E. Holley Poe, director, Natural Gas and Natural Gasoline Division, Petroleum Administration for War, reviewed the petroleum industry developments and their effect on the gas industry. He traced tanker movements of oil during the critical period and described the pipe lines built or contemplated to alleviate the situation. He warned that, while current demands could be met, there was no large cushion of stocks to be used in meeting stepped up demand caused by emergencies.

In reviewing the New England Gas Association's year, Mr. Belden emphasized the cooperation extended to government agencies in solving war problems, pointing out that 498 war program releases had been issued by N.E.G.A. during the year.

Post-War Pattern

A proposed pattern for revamping the gas industry in New England was outlined by John West, president, The New England Gas Association, in his presidential address. Mr. West called for post-war consideration of the desirability of interconnecting all New England gas company facilities, introducing a standard uniform type of gas, tieing in more closely with the chemical industry, and investigating new production and distribution methods.

Activities of the American Gas Association were described by Major Alexander Forward, managing director, and Ernest R. Acker, vice-president and chairman of the A. G. A. Committee on War Activities. Mr. Acker's able discussion of the industry's war activities is presented in full elsewhere in this issue.

Speaking on "Home Service in Wartime," George S. Jones, Jr., vice-president and general sales manager, Servel, Inc., pointed out that the goodwill service of the home service department is a potent instrument for developing the public support which all industry, and especially the gas industry, will need in the post-war adjustment period. He declared that the contribution of the home service girl must offset the 40 million calls the gas appliance salesmen are no longer making.

Post-war planning from the manufacturers' viewpoint is a "must" item, Colonel Willard F. Rockwell, president of the Association of Gas Appliance and Equipment Manufacturers, told the conference. "There never is a time when a successful manufacturer can avoid the necessity for planning." He expressed his conviction that "the gas industry is going into the greatest expansion it has ever known" and that tremendous accumulative demands await the manufacturers at the end of war.

C. O. Ruggles, professor of public utility management and regulation and director of Division of Research of Harvard Graduate School of Business Administration, made an authoritative analysis of trends in utility regulation. E. C. Robbins, professor of industrial management at the Harvard graduate school, spoke on management and labor cooperation.

The conference included an interesting panel discussion on cold weather emergency operations led by R. J. Rutherford, vice-president, Worcester Gas Light Company.

Cities Service Company Sets New Records

OUTLINING an extensive program of war work, W. Alton Jones, president of the Cities Service Company, disclosed in his report for 1942 that the concern and its subsidiaries set new records in the petroleum, utility and natural gas fields.

Gross operating revenues of the system rose to a new record level of $280,198,136 from $260,947,398 in 1941, Mr. Jones reported. Consolidated net income was $16,938,532, against $14,283,892, an increase of $2,654,640.

Sales of natural gas by subsidiaries in the system last year were 196,000,000,000 cubic feet, the highest on record, and an increase of 21,000,000,000 cubic feet over 1941. Industrial gas sales were 13 per cent higher, while residential and commercial gas sales were up 11 per cent.

Mr. Jones, who is also president of War Emergency Pipelines, which is constructing and operating the government's pipe line from Texas to the East Coast, reported that the Cities Service system had supplied a variety of products in large volume to many branches of the armed services and to lend-lease.

Contributions to War

The company's contributions to the war, Mr. Jones said, included construction of new refineries for production of aviation gasoline, building and operation for the government of one of the largest butadiene plants, a large munitions plant and participation in various oil pipe line projects to relieve the East Coast shortage of petroleum products. In addition, he reported, the various station outlets of the system collected 44,500,000 pounds of scrap rubber in the government's salvage drive.

Mr. Jones also paid tribute to Harold L. Ickes, Petroleum Administrator for War, for "far-sighted understanding" of the innumerable problems of the oil industry.

HOW TO STRETCH YOUR 48 RATION POINTS
(and Still Serve Nutritious Meals)
YOUR WARTIME Gas Kitchen Counselor
NUMBER 2 OF A SERIES
1. You have a limited number of ration points to "spend." To stretch their purchasing power, in terms of food values, you'll need to be nutrition-wise and shop, plan and cook carefully.
2. It's a good idea to budget ration points just as you do your monthly food money. And then you can serve well-balanced meals all month.
3. To make your points go farther, draw on non-rationed foods. Whenever possible, buy fresh fruits and vegetables for vitamins and minerals.
4. Learn about new foods—new ways to fix old favorites. Many of these are not rationed and offer a surprising amount of food value.
5. Stretch nutritional values all you can—retain all the minerals and vitamins possible in the foods you buy. Controlled gas cooking helps.
6. Do not waste food—store left-overs properly. Stretch them into tempting and "different" dishes that will keep your family strong and well.
7. Stretch your supply of "store" foods and vitamins with vegetables from your own victory garden, even if it's only a window box of parsley or carrots.
You may rub your eyes a bit this first week or two of food rationing, but it's true—there are two "prices" on that can of peaches there on the grocer's shelf these days, one price in cold, hard cash and another in ration points.
☆
So now in addition to the old familiar problem of making your cash money go as far as possible you'll need to find ways of stretching your ration-point "money," too.
☆
And it's an art! If you invest a coupon in a can of peaches, for example, instead of using it all at one time in just one dessert—you'll be rationwise to make it do for several.
☆
Since variety is so important, you might first try a peach shortcake—then a couple of days later use the rest of the peaches in tapioca, brown betty or an upside down cake. That's *stretching*—combining a rationed food with other foods that are non-rationed.
☆
Just as you "stretch a point," you can stretch your vitamins, and minerals, too, by not wasting them. If you are going to use only a portion of a can of peas, heat just the part you need, quickly setting the rest of them in their original container, covered, in the refrigerator.
☆
How you heat the peas is important, too, in this fine art of stretching food values. Like all canned foods, they are already cooked and really cooking them again results in heavy loss of nutritive value.
WARTIME GAS COOKING SAVES VITAMINS AND MINERALS
SOUTHERN CALIFORNIA GAS COMPANY
SOUTHERN COUNTIES GAS COMPANY

One in a new series of "ads" sponsored by the Southern California gas companies dealing with the vital subjects of food in wartime. Authentic nutritional information and helpful suggestions for cooking under wartime rationing conditions are presented under the direction of the Home Service Departments which are conducting cooking schools tieing in with the series

Attention Hitler and Hirohito

IMPORTANT developments are underway in the gas industry, too. In cooking, water heating, house heating, refrigeration and air conditioning, manufacturers and the American Gas Association testing laboratories are striving to make gas appliances outstanding in performance and efficiency. They are giving attention, too, to the industrial use of gas, particularly where controlled heat is essential.

Today the superior electric generating and gas manufacturing facilities of our nation are making it possible for us to overwhelm our enemies by production. Tomorrow the continued expansion of our business will bring new heights of pleasure, leisure and health to the United States of America.—(From the Annual Report to Employees of The Connecticut Light & Power Company)

ON FOOD RATIONING

H. I. Phillips, noted columnist, quoting his famous mouthpiece, Elmer Twitchell, comments on rationing:

"My wife seemed to have forgotten that food came out of the ground. She developed the notion that men could live via the canning corporations alone. She thought food was something dependent on complete liaison between the tin mines, the beaneries and the gas range."

Get on the Beam!
Buy WAR BONDS on Payday.

Personal AND OTHERWISE

Honored on 45-Year Service Record

John A. Clark

JOHN A. CLARK, vice-president in charge of gas operation, Public Service Electric and Gas Company, was guest March 1 at an informal luncheon at the Essex Club, Newark, N. J., given by his associates in the general office of the gas department of the company. Mr. Clark on February 28 completed forty-five years with Public Service and predecessor companies.

Mr. Clark was made vice-president in charge of gas operation in June, 1926, having been promoted to succeed the late Henry D. Whitcomb. He had joined the Newark Gas Company, a predecessor company of Public Service on March 1, 1898.

Named General Manager of Wyandotte Company

Clarence H. Waring

CLARENCE H. WARING, for many years general superintendent of the Kansas City Gas Company and The Wyandotte County Gas Company, has been named general manager of the Wyandotte company, succeeding the late William H. McKenzie, who died February 12. Announcement of Mr. McKenzie's successor was made in Kansas City, Kansas, on Tuesday, March 9, by Benjamin C. Adams, president of the Wyandotte Company.

Mr. Waring has worked in an executive capacity in the Kansas City, Kansas, organization, with the exception of a few years since 1905 and during all those years was closely associated with Mr. McKenzie. For a number of years he has been a director of the Wyandotte company as well as a director of The Gas Service Company.

For many years Mr. Waring has been an active and valuable member of various American Gas Association Committees, particularly Distribution, having been past chairman of that committee. He is a member of the Managing Committee of the A. G. A. Laboratories and chairman of the A.S.A. Sectional Committee, Project Z 21, A. G. A. Provisional Requirements Committee.

T. J. Strickler, vice-president and general manager of the Kansas City Gas Company, has announced that R. K. Murduck will succeed Mr. Waring as general superintendent of the company. Mr. Murduck has worked in the engineering department of the Kansas City Gas Company since 1916, and since 1920 has been general foreman of the Street Department.

Niagara Hudson Director

GEORGE H. CAMPBELL, of Oswego, New York, has been elected a director of Niagara Hudson Power Corporation, it was announced Feb. 26. Mr. Campbell is president of George H. Campbell & Co., Inc., of Oswego. Mr. Campbell is also a director of Central New York Power Corporation, one of the principal operating companies of the Niagara Hudson System.

I. K. Peck Honored

I. K. Peck, president of the Binghamton Gas Company (right), receives an eight-pound sledge hammer to back up his newly acquired authority as president of the Binghamton Chamber of Commerce. Retiring President Stuart M. English made the presentation at the annual dinner meeting February 12 which was attended by 600 people

Heads Southern Counties Home Service

APPOINTMENT of Katherine Rathbone, for several years home service director in the Santa Monica Bay district of Southern Counties Gas Company, to become the first home service supervisor of all the company properties was announced on March 1 by N. R. McKee, vice-president. Miss Rathbone will move shortly to the Los Angeles office where she will have her headquarters.

In her new position, she will be responsible for the coordination of home service activities throughout the company.

A graduate of Washington State College, Miss Rathbone has been with Southern Counties since 1927. She is chairman of the Home Service Section of the Pacific Coast Gas Association and is a member of the Home Service Committee of the American Gas Association.

Ohio Society Elects

W. A. Dougherty

WILLIAM A. DOUGHERTY, of Gas Companies, Inc., New York, N. Y., widely known legal authority, was elected president of the Ohio Society of New York at the annual dinner meeting March 8 at the Hotel Pennsylvania, New York, N. Y. Mr. Dougherty has been a valuable contributor to meetings of the American Gas Association, particularly in summarizing court and commission decisions.

McCloy and Kerr Retire

WALTER L. McCLOY, vice-president of The Ohio Fuel Gas Co., Columbus, Ohio, retired from active duty March 1 after 55 years of continuous service in the natural gas and oil industry.

Mr. McCloy was associated with the Philadelphia Co. and affiliated companies at Pittsburgh, Pa., from 1888 until 1920 when he became vice-president of the Guffey-Gillespie Oil Co. with headquarters at Tulsa. He was later associated with J. S. Cullinan in activities in the Monroe gas field in Louisiana. For the past 19 years he has been connected with Ohio Fuel, a subsidiary of Columbia Gas & Electric Corp. While retiring from active duty, he is retained in a consulting capacity and continues as a member of the board of directors.

Thomas H. Kerr, vice-president in charge of transmission and distribution, retired as of the same date. He also continues as a member of the board.

Appointed Home Service Director

Kathryn L. Barnes

KATHRYN L. BARNES has been appointed director of the home service division of the Equitable Gas Company, Pittsburgh, Pa., effective March 1, according to an announcement by D. P. Hartson, vice-president and general manager of the company.

Miss Barnes is a native of Buffalo, New York, and majored in Home Economics at the Buffalo State Teachers College. She obtained a ground work of extensive practical experience with the Iroquois Gas Company of Buffalo, serving under the direction of Mrs. Louella M. Fisher, nationally recognized as a home service authority. Miss Barnes later became home service director with the Pennsylvania Gas Company in Erie.

Jesser Promoted

FRED A. JESSER of Charleston, who has been assistant treasurer of the United Fuel Gas Company and associate companies of the Charleston group of Columbia Gas and Electric Corporation, since 1929, has been elected treasurer of those companies to succeed W. J. Hightower.

Mr. Hightower retains the office of vice-president of those companies, to which he was recently elected.

Mr. Jesser has been connected with the United Fuel Gas Company and associate companies since 1917.

On Copy Committee

H. CARL WOLF, chairman of the Committee on National Advertising, announces the appointment of Roger A. Gordon, acting general sales manager, Washington Gas Light Company, Washington, D. C., to the Subcommittee on Approval of Domestic Gas Copy.

This committee executes copy, layout and other details in connection with the conduct of the gas industry's national advertising program, on instructions from Mr. Wolf's committee.

WAAC Promotion

ANNOUNCEMENT has been made at the Third Training Center of the Women's Army Auxiliary Corps of the assignment of Third Officer Ida Shirley Martin of 123 Keeler Avenue, Bridgeport, Conn., as Battalion Commander of the Second Battalion of the 22nd Training Regiment at Fort Oglethorpe, Georgia. Third Officer Martin was sales representative for the Bridgeport Gas Light Company for six years. At the Bullard Company in the same city, she was secretary to the production manager.

In War Work

B. H. Gardner

BEN H. GARDNER, chairman of the A. G. A. Industrial and Commercial Gas Section, is on leave from the Columbia Engineering Corporation of which he is vice-president and is serving the government in the war effort as deputy director, requirements division, Surgeon General's Office.

Mr. Gardner, who is continuing his leadership of the Industrial and Commercial Gas Section, is located in the Maritime Building, Washington, D. C.

In the Navy Now

Beatrice L. Geesey

BEATRICE L. GEESEY, member of the sales department office staff of Michigan Consolidated Gas Company, Grand Rapids, has entered the WAVES, reporting for indoctrination at Hunter College, New York City.

Miss Geesey had worked in the sales department at Grand Rapids since 1936. Always active in company affairs, she was perennial choice to "glamorize" a float in the Annual Old Range Round-Up parades, and is the first girl employee of the district to enter military service. Prior to leaving, she was voted "Girl-of-the-Month" by her fellow employees.

Ruthenburg Appointed State Chairman

LOUIS RUTHENBURG, president of Servel, Inc., Evansville, Ind., has been appointed Indiana State Chairman of the Committee for Economic Development. The appointment was announced by Paul G. Hoffman, president of Studebaker Corporation, South Bend, Ind., who is serving as national chairman of the committee.

The purpose of the committee is to lay ground work for postwar employment by private industry. The committee, Mr. Hoffman said, is not a government agency, although it was created at the suggestion of Jesse H. Jones, Secretary of Commerce, and is working with the Department of Commerce and other government agencies.

CONVENTION CALENDAR

APRIL

Apr. 16-17 **Missouri Association of Public Utilities**
Elms Hotel, Excelsior Springs, Mo.

27-28 **A. G. A.-E. E. I. Accounting Conference**
Netherland-Plaza Hotel, Cincinnati, Ohio

26-29 **U. S. Chamber of Commerce**
Waldorf-Astoria, New York, N. Y.

28 **A. G. A. Natural Gas Management Conference**
Hotel Gibson, Cincinnati, Ohio

29-30 **A. G. A. Distribution Conference**
Netherland-Plaza Hotel, Cincinnati, Ohio

MAY

May 4 **A. G. A. Motor Vehicle Conference**
Pennsylvania Hotel, New York, N. Y.

4 **Pennsylvania Gas Association**
Philadelphia, Pa.

10-14 **National Fire Protection Association**
Palmer House, Chicago, Ill.

24-25 **Production and Chemical Committee Conference**
Pennsylvania Hotel, New York, N. Y.

JUNE

June 7-9 **National Office Management Association Annual Conference**
Detroit, Mich.

18-21 **American Home Economics Association**
Jefferson Hotel, St. Louis, Mo.

NOVEMBER

Nov. 29-Dec. 3 **American Society of Mechanical Engineers**
New York, N. Y.

Gas and Electric Industry Accountants To Meet in Cincinnati, April 27-28

UTILITY accountants will get together April 27 and 28 at the Netherland Plaza Hotel, Cincinnati, Ohio, for a discussion of mutual problems which have arisen since their last meeting, and to discuss solutions and procedures which have been developed. Each branch and department of these two industries has its specific problems, aggravated at the present time by war emergencies. Every industry accountant knows how extensively every one of these problems affect his particular department, and finds it of great value to get together with his fellow accountants for open discussions of them.

The program is being prepared by Co-chairmen O. H. Ritenour, Washington Gas Light Company for the American Gas Association, and H. R. Flanegan, Philadelphia Electric Company, for the Edison Electric Institute, assisted by a committee of representatives from each association.

The usual schedule of meetings will be reversed for this conference, the Group Meetings being held the first day of the Conference before the General Session which will be held on the second day.

General Session, Wed., April 28

The General Session on Wednesday the 28th will convene at 9:30 A.M. at which time all those attending the Conference will hear H. C. Blackwell, President, Cincinnati Gas and Electric Company, welcome them to Cincinnati and discuss general problems facing the two industries. Other prominent speakers from the industry, and other business fields, will address the session on manpower problems, trends in regulations, materials rationing, post-war planning and other pertinent and timely subjects. L. A. Mayo, The Connecticut Light and Power Company and F. B. Flahive, Columbia Gas and Electric System, will preside.

The Group Conferences to consider specific problems relating to various accounting departments will be in session all day Tuesday the 27th. There will be several such groups and these conferences will get under way at 10:00 A.M.

Customer Activities groups will consider results thus far obtained from:

- Meter reading and billing at periods other than monthly.
- Changes made necessary by tire and gasoline rationing.
- Manpower shortages

and problems peculiar to customer accounting, credits, and collections. Panel discussion periods covering these and other subjects will be a part of the Customer Activities Group meetings.

Leaders of A. G. A. accounting activities who have arranged a comprehensive program for the Cincinnati conference. Left to right: E. F. Embree, coordinator, Customer Activities Group; L. A. Mayo, chairman, Accounting Section; O. H. Ritenour, vice-chairman, Accounting Section, and Program Committee chairman; and R. E. Hull, coordinator, General Accounting Group

General Accounting groups will discuss studies now being made by cooperating committees of the A. G. A. and E. E. I. relating to:

- Amortization of defense and war facilities
- Internal reports and audits
- Simplification of reports
- Protection and preservation of records
- Reserves for post war adjustments
- Streamlining of uniform systems of accounts;

also, such pertinent subjects, as salary stabilization requirements, depreciation, tax accounting, property records, etc.

These groups will continue their discussions at 2:00 P.M. Tuesday.

So many timely and important subjects have been suggested for these group conferences, it is anticipated that one full day will be insufficient for complete coverage. Luncheon Conferences will be arranged for Wednesday to continue until completion of the program.

Final programs will be in the mail in the near future.

Fuel Surcharges

GAS companies which have put into effect Fuel Surcharges or War Emergency Surcharges from May 1, 1942 to February 1, 1943, have been listed by the statistical department of the American Gas Association.

They are thirty-five in number, in the States of Connecticut, Florida, Idaho, Maine, Maryland, Massachusetts, North Carolina, New Hampshire and Oregon.

The former A. G. A. Rate List showed about 110 pre-war fuel surcharges in effect, about half of them in New England. Some of the new surcharges supersede old ones of the same companies.

Some wartime surcharges deal only with increased cost of oil or coal, while others cover as well costs of boiler fuel, generator fuel, coke factors, et cetera.

Meter Error Allowable

FOLLOWING an order by the WPB, the Pennsylvania Public Utility Commission has issued an order which temporarily increases from two per cent to four per cent the present allowable error in gas-meter recordings and suspends the Commission's rule requiring that such meters must be checked every five years for accuracy. The order is effective until the end of this year.

Depreciation in Perspective

- **Abridged from a paper by H. C. Hasbrouck, Chairman, Committee on Depreciation Accounting, American Gas Association. Originally presented before the Technical Valuation Society in January, 1942.**
- **Material assembled for the recent release under the joint sponsorship of the A. G. A. and E.E.I. Depreciation Committees entitled "History of Depreciation Accounting in Electric and Gas Utilities."**

H. C. Hasbrouck

ACCOUNTANCY is a very old art, as old as civilization itself. Accounting records have been found written in Egyptian hieroglyphics and on sun-baked clay tablets from the ruins of Babylon. I have no doubt that the as yet indecipherable inscriptions from the Mayan temples and palaces of Yucatan will some day be found to include cost accounting records. The concept of depreciation as a factor in cost accounting is, however, relatively new. Nevertheless, I have been able to find (in an article by Professor Henry Rand Hatfield entitled "What They Say About Depreciation," published in the Accounting Review for March, 1936) references to depreciation accounting in writings by Inglis, 1861; by Mellis, 1588; and by Francisco di Marco da Prato in 1408.

Early Depreciation Accounting

Professor Hatfield's article even mentions (giving credit to an earlier paper by H. E. Hale on "What Is Depreciation," published in Railway Age for February 16, 1929) a treatise on architecture by a little known writer named Vitruvius, who lived in the time of the Roman Emperor Augustus, and who is said to have stated that in valuing a masonry wall 1/80th of the cost should be deducted for each year of its life, on the assumption that such life would be 80 years. This, obviously, is straight line depreciation in its crudest form; and if anyone ever suggests that straight line depreciation accounting is a modern idea and therefore preferable to any notions of the horse-and-buggy age, a perfectly proper rejoinder would be that straight line depreciation accounting is many centuries older than the horse and buggy, but is even today used about as crudely as it was by old Vitruvius.

Exhaustive research into professional accounting literature of Europe or even of England is beyond the scope of this paper, but for the purpose of our American perspective, a few early references will give some suggestion of how industry in this country started to think about recording depreciation in the accounts. We may begin with a statement by Professor Henry Rand Hatfield, in the paper already quoted. He says: ". . . certainly, until relatively few years ago very many American corporations made no reference to depreciation in their published statements."

It is safe to consider that early American business gave little or no recognition in the accounts to depreciation, except as it was brought face to face with it when property was sold at a loss, or when some other equally inescapable event took place. In fact, not only business but the courts of the United States frowned upon any recognition of depreciation in the accounts before its definitive realization, and some court decisions were rather stern in characterizing charges for such depreciation as attempts to deceive. One of the outstanding court decisions usually referred to in historical studies of depreciation is that delivered in 1878 by the United States Supreme Court in "United States vs. Kansas Pacific Railway Company" (99 U.S. 455), wherein the practice of creating depreciation reserves by periodic charges to operating expense was adversely criticized, and the Court held that only the cost of actual renewals of property at the time they were made could be legitimate expense charges. Other courts naturally followed this doctrine, and it was not until the famous and frequently quoted decision of the United States Supreme Court in "Knoxville vs. Knoxville Water Company" (212 U.S. 1), handed down in 1909, that there was authoritative legal support in this country for recognition in the accounts of depreciation before actual retirement or replacement. Some excerpts from this history-making decision are quoted below:

"A water plant . . . begins to depreciate in value from the moment of its use. . . . The company is not bound to see its property gradually waste, without making provision out of earnings for its replacement. It is entitled to see that from earnings the value of the property invested is kept unimpaired, so that at the end of any given term of years the original investment remains as it was at the beginning. It is not only the right of the company to make such a provision but it is its duty to its bond and stockholders, and in the case of a public service corporation at least, its plain duty to the public."

It is clear from the above quotation that the Court was thinking in terms of accounting for lost value, not of cost accounting, and made the rather naive assumption that a management could without too much difficulty determine with practical accuracy how much value was lost from its property in any accounting period and charge it up as an expense of that period. The existence of the Technical Valuation Society is evidence that lost value can not be so simply determined.

The practice approved in 1878 by the United States Supreme Court in the Kansas Pacific case already referred to, of recognizing depreciation only to the extent of charging the cost of renewals to operating expenses, was undoubtedly very generally followed by industrial and public utility management, and was considered to be sound and conservative accounting for many years. I suspect that there are still some hardheaded managers of successful enterprises who would tell you that such accounting is as good as any method to deal with the fact of depreciation in a practical way. The railroads, among the earliest of the gigantic aggregations of capital which are the characteristic feature of the modern economic world, certainly did not, until required by regulatory authority to do so within certain limits, give any specific recognition to depreciation in their accounts, although some of them roughly compensated for lack of depreciation charges by charging to maintenance and operating accounts large sums for additions and betterments.

No Standard Practice

So recently as 1912, a leading authority on the art and practice of accounting shrank from any dogmatic pronouncement on the necessity of recognizing depreciation in the accounts before it could be measured. In the first edition of Robert H. Montgomery's standard work on "Auditing—Theory and Practice," published in that year, the author, while apparently favoring substantial depreciation reserves as a matter of conservative accounting, calls attention to "the general practice of omitting this (depreciation) and other items from ordinary operating accounts," and says that "accountants of experience defend this practice."

Until well after the close of the nineteenth century, there was little in the practice of those concerned with the finances and accounts of American business to show any standard or generally accepted attitude toward the recognition of depreciation in the accounts before it is actually realized through the retirement or abandonment of an asset. Some industries adopted the policy of making relatively heavy charges for depreciation and accumulating correspondingly large reserves. Other managements took the position that anything more than minimum charges and reserves would constitute an unwarranted withholding of distributable profits or an unjustifiable increase in the cost of the industry's product, whether goods or services. Accountants while pre-

ferring fairly large charges on the ground of conservatism, were not too insistent on definite standards; and engineers were inclined to think that detailed studies designed to establish scientific objective standards for the measurement of depreciation prior to actual retirement were a waste of time. Some of them still think so. However, there was developing a body of thought supporting the principle that current costs are understated unless they are charged with some part of the loss which will not be definitely established until at time of retirement the then value of property is compared with its cost.

Terminology Held Unsound

By 1920, the accountants of the electric and gas industries had come to see the importance of the distinction between the accountant's concept of depreciation charges as a device for better cost accounting, and the more fundamental and commoner concept of depreciation charges as a recognition of lost value. Accountants of regulatory commission staffs had been thinking along similar lines, and the result was the bold attempt in 1920, by the joint efforts of the Committee on Statistics and Accounts of Public Utilities of the National Association of Railroad and Utilities Commissioners and the accounting committees representing the National Electric Light Association and the American Gas Association, to promulgate a classification of accounts that would eliminate entirely the word "depreciation" because of its ambiguity, not because anyone objected to sound cost accounting. What the 1920 NARUC Committee tried to do is best expressed in the language of George C. Mathews, then a member of that committee and of the staff of the Wisconsin Public Service Commission, in an address before the National Electric Light Association's Accounting Section in 1922, on "The Commissioners' Uniform Classification of Accounts." He said:

"The term 'depreciation' seems to me to have been an unfortunate one and responsible for many of the difficulties in the relations between regulatory bodies and the industry. Where a reserve for depreciation is established there is more or less of an implication that the actual value of the property has diminished in proportion to the accumulation in the reserve. . . . It seemed to those on the accounting committees which were responsible for the Commissioners' classification that it was not safe to go on the assumption that value diminished strictly in proportion to age or that the decrease in value would be measured entirely by an accumulated reserve. After all, the purpose of making the provision for depreciation or for retirement, no matter which term is used, I think is properly described by the language of the new classification to the effect that the reserve is to cover the retirement loss. . . . The new procedure is a definite attempt to dissociate the accounting for retirement losses from any relationship to depreciated value at a given time."

The well meant efforts of the regulatory commission accountants and the accountants of the electric and gas industries to remove the ambiguity attached to the word "depreciation" as an accounting term by substituting the phrase "retirement expense" or "retirement cost," so as to emphasize the accounting concept rather than the valuation concept of the function of charges recognizing possible or probable loss in advance of its definitive realization, have not been entirely successful. The word "depreciation" has proved to be too firmly imbedded in our financial language to be eradicated from accounting terminology. However, the thought behind the change in terminology, as expressed in the preceding quotation from Mr. Mathews, is still sound. The latest pronouncement by the Depreciation Committee of the NARUC on principles of depreciation accounting for regulated utilities is in its report to the Association for 1939, and this report contains the following significant language:

"Depreciation in the accounting sense has to do with the recording of costs and is not synonymous with losses in fair value. *Value* may differ from *cost*. Strictly speaking, the term 'depreciation in value' should not be used in utility property accounting. In arriving at fair value, depreciation of property on whatever basis the cost is stated may be considered, together with other relevant factors. Such depreciation estimates, however, are not depreciation of value. Rather, they are merely some of the steps necessary to a determination of value."

May I summarize in a few concluding sentences what from a long perspective I conceive to be some significant historical generalizations.

A Finance and Accounting Problem

The depreciation problem is primarily a financial and accounting problem. General appreciation of its practical aspects in financing and accounting is a comparatively modern phenomenon, one, say, of the last 40 years, although earlier efforts to establish a basis for the recognition of depreciation in the accounts before its definitive realization are by no means uncommon. The development of thinking about depreciation has been greatly confused by failure to distinguish between two profoundly different, though closely related, concepts. These are the concept of depreciation charges as a recognition of a loss in value occurring during a definite period of time; and the concept of depreciation charges as an accounting device for prorating or distributing costs.

There is no simple, generally adaptable formula for determining the amount of value lost by depreciable property either during the entire period between the date of its acquisition and a later date prior to its actual retirement, or during a given year or other subdivision of such a period, for accounting purposes. Neither is there such a formula for amortizing or spreading cost over probable life in service because, except in a relatively few simple instances, service life can not be estimated with a high degree of accuracy. Except within very wide limits of error, therefore, depreciation charges and reserves can not be judged by purely objective standards. However, in my opinion, there should be a practical solution for the depreciation controversy if certain prima facie maximum and minimum limits for depreciation charges and reserves can be established by agreement among responsible and experienced authorities for each major type of depreciable property, leaving for argument only a relatively few exceptional cases.

Gas in Germany

THE *Munchner Neuste Nachrichten* recently warned Munich householders not to leave their gas burning low, as, owing to enemy action on the one hand and increased consumption on the other, the pressure was very low during certain hours and small burners were apt to go out. It was particularly requested that the housewives should prepare their meals at time of good pressure and avoid the use of gas during the hours between 10 A.M. and 2 P.M. as food would not only take much longer to cook, but a considerable amount of gas would be wasted.

The Lahr Gasworks announced that despite Goering's many appeals for economy in the use of power and gas, consumption in the Lahr district has still increased. In order to safeguard the gasworks service and replenish the reserves of gas as quickly as possible, thus making sure of normal services, the gas supply will be cut off from 9 P.M. to 5 A.M., from 8 A.M. to 10:30 and from 1 P.M. to 6 P.M. Gas will be obtainable on Sundays from 6 A.M. to 9 A.M. instead of from 5 A.M. to 8 A.M. The utmost economy may make it possible to reintroduce the normal gas supply later.

MR. AND MRS.—"Looking Ahead" **Arthur Folwell and Ellison Hoover**

I CAN'T JUST RUN OUT AND BUY ANOTHER GAS STOVE, JOE. YOU KNOW NOWADAYS WE'VE GOT TO TAKE CARE OF EVERYTHING WE HAVE
I KNOW, VI
REMINDS ME TO INCREASE MY PAYROLL SAVINGS FOR WAR BONDS
FINE. BUT HOW DOES THAT REMIND YOU?
WHAT BETTER WAY IS THERE TO TAKE CARE OF EVERYTHING WE HAVE?
I GET IT. AND EVERYTHING WERE GOING TO HAVE!

The Gas Industry's Post-War Planning Program

By A. M. BEEBEE

Chairman, Post-War Planning Committee

AS pointed out in previous issues of the MONTHLY, the Post-War Planning Committee of the American Gas Association was formed to deal intelligently and with forethought with the tremendous effects of America's participation in the global war. Its membership includes representatives from every branch of the industry and its activities will encompass technical, marketing and merchandising fields.

The committee feels that post war planning, unless carefully formulated, is apt to involve such a wide field as to be very confusing. Much that we have seen and read resolves itself into the sphere of phantom chasing and spreading one's efforts so thin as to be of no value.

It is also quite apparent that it is too broad a subject for each company to analyze for itself. On the other hand, we are all convinced that no association activity can do all the post-war planning for all the companies. There is, however, a very definite service that combined post-war planning can perform for the industry, and it is along that line that our A. G. A. Post-War Planning Committee is endeavoring to function.

In other words, we feel that there are some basic fundamentals facing the industry which all companies will need information upon, in order to properly plan their own post-war planning activity. These fundamentals are of a definite nature and do not involve much of the visionary objectives that so often characterize post-war planning. As a result, our Post-War Planning Committee has initiated the study of four rather basic fundamental subjects which we feel will pretty much affect the entire industry, both natural gas and manufactured gas alike.

It is our thought that after these four basic studies have been pretty well completed, they can be the very foundation stones on which to build post-war planning, both of an industry wide nature, and also by individual companies.

These four basic studies are as follows:

(a) *Post-War Purchasing Power and Potential Markets.*

C. V. Sorenson, supervisor, new business, Midland Utilities Co., Hammond, Indiana, *chairman.*

This phase of the gas industry's post-war planning activity will attempt to develop the changes that have taken place in the potential purchasing power, spendable income, shifts in population, consumers' preferences and types of housing construction as a result of the war, so as to enable a forecast to be made as to the markets that lie ahead for gas consuming appliances, neglecting competitive factors. In other words, this activity is the advance guard out in front of the front lines seeing what lies ahead.

It is not necessary to emphasize that there have been great changes in the location of spendable income and purchasing power in this country and the fact that their present location may have a surprisingly low saturation of appliances indicates the likelihood of tremendous potential markets.

(b) *Factors Affecting the Realization of the Potential Markets.*

R. J. Rutherford, vice-president, Worcester Gas Light Co., Worcester, Mass., *chairman.*

R. E. Ginna, assistant to the president, Rochester Gas and Electric Corp., Rochester, N. Y., *sub-group chairman.*

This phase of the committee activity will study the development of competitive factors that may prevent us from, and also may aid us in, achieving the potential market developed by Study "A." In other words, Mr. Rutherford's committee is the intelligence division trying to determine the strength and activity of the enemy.

The great changes which have taken place in the oil industry may be the means of placing on our door step loads requiring heat in a quantity undreamed of before. On the other hand, the competitive conditions which the electric industry may be in a position to throw into our basic market may likewise be tremendous and Mr. Ginna's committee is to study the economics and potential strength of that competition.

(c) *Engineering and Economic Aspects of Our Own Ability to Satisfy the Potential Market.*

Hall M. Henry, Negea Service Corp., Cambridge, Mass., *Chairman.*

This phase of our program will be given over to a study of the economic factors which we have definitely in our favor to enable us to overcome the enemy as well as to study the weak points in our defense. In other words, Mr. Henry is our General in charge of those factors which supervise the bringing up of supplies and passing the ammunition.

Since it is possible that factors developed by Mr. Rutherford's committee may show house heating loads to be available in quantities heretofore unrealized, it is proposed to review the economics of this subject which was originally studied in 1936 by bringing that study up to date and to enlarge it so as to include the cost of production as well as transmission and distribution. There is one very strong fundamental advantage that gas enjoys, namely, that the cost of mains increases as a direct function of the diameter, while the capacity of the main increases as the square of the diameter. This means eventually that large volume, low load factor loads (heating loads) can be taken on, on top of existing base loads at a cost surprisingly low.

Technical Studies Contemplated

Studies involving both the transmission and distribution of gas have shown that these factors are more of an asset than is generally realized and the strength of this asset will be fully developed. As to whether connecting forms of energy enjoy any such advantage will be likewise appraised. This phase of our program will also study the shortcomings of our existing equipment, in order to hold the vital base load which is essential in the economic picture we are trying to develop.

This phase will likewise study the economics of the research that our industry should be considering to better enable us to meet competitive markets. There is no question but what the basic fuel of this country is coal and where heat is desired some two to three times as many heat units can be transported to the customer in the form of gas as can be transported to the customer in the form of electricity. Likewise since some 2/3 of the energy used in a community is in the form of heat, the potential market that lies ahead for our industry is tremendous, if we properly gear ourselves to meet it. Our present method of upgrading soft coal into gas and solid fuel (coke) tends to produce fuels which compete with one another. The more heat load that we take on with gas from such a process, the more coke we must sell to compete with that market. This committee will therefore study the matter of research to solve this problem, which suggests the upgrading of coals into gas and oils.

It will likewise consider the possibilities of complete gasification, and increasing the

thermal value of the resultant low thermal value gases which are bound to result from such types of operation. Research carried on in pursuance of the objective of upgrading low thermal value gases will not be waste effort, even if complete gasification fails to develop economically, for such research very definitely fits into the field of upgrading of coals into gas and oils. The difficulty with complete gasification processes, however, is that the cost of conversion must all be borne by one product, namely, gas. It is for this reason that the possibility of upgrading coals into oil, as well as gas, intrigues the imagination, as the cost of conversion can then be borne by two products rather than one, such as now takes place in the present coal carbonizing plant. This ability to share costs of conversion (in the past decades) has tended to make coal carbonization economic in many cases.

The trend of times, however, may mean that, instead of bringing coal to communities to make gas and coke, as we now do, the plant of the future will consider transporting coal to a community to produce gas and oil (motor fuel). It has long been proven a basic fundamental that transportation of coal in railroad cars to a community is the cheapest form of transmitting energy and will probably continue. The making of the energy of the coal available in an ashless form, as well as in more convenient form, should be the objective of our industry. This committee will attempt to suggest the most economical manner in which this can be done.

This activity will likewise study gas production and distribution trends, gas extention policies and a host of other problems within our industry.

(d) *The Effect of National Planning and Trends.*

Walter C. Beckjord, vice-president and general manager, Columbia Gas & Electric Corp., New York, N. Y., *chairman.*

This phase of the program will study those general economic developments of a general social nature, such as government planning, etc. which may affect our markets and our ability to realize the potential market developed by Mr. Sorenson's activity. In other words, Mr. Beckjord's committee will be engaged in reconnaissance work to determine what other factors may affect the present battle scene and which may not immediately be involved in the battle.

From the above I think you can appreciate that our program is a very far reaching one, and when the committees have finished their studies, the results should be some fundamental building blocks on which post war planning can be safely and wisely built. In other words, after these studies are finished, we can then consider the type of sales activities and policies, dealer and utility relationship, and other forms of enterprise that the industry should consider, in order to better enable it to achieve its legitimate market.

The Post-War Planning Committee has felt that there were certain phases of our activity that were self-evident and we have already drawn up two resolutions which were presented to the Executive Board of the A. G. A. and favorably voted upon by that body. These resolutions are as follows and no comment is necessary on them since they are self-explanatory.

RESOLUTION No. 1

"In view of the many forces that are at work created by the War, by competing industries, and by various phases of social and economic planning, it is vital to the welfare of our industry that we actively support, promote and further develop the National Advertising Program of the gas industry.

"The Post-War Planning Committee later on will develop data to bring to the attention of the industry the seriousness of the situation outlined above. In the meantime, however, we feel it important to call this matter to the attention of the gas industry at the earliest possible moment, so that no time will be lost in lending our support to this most vital activity."

RESOLUTION No. 2

"Because of the needs of the country generally at this time, it is recommended that the gas industry give wholehearted support to the subject of building insulation. Such a move not only fits in very definitely with the national need at this time but when the post-war season is on us, every home that is insulated can better afford to consider the use of gas fuel."

There is another factor that is a vital one from the gas industry's point of view, which should be helpful to us in our post-war situation and that is that as business recession takes place, the gas industry will tend to recoup in reduced operating expenses a large share of their loss in net revenue. This situation in our industry is one which may be enjoyed by few industries in the post-war period. Especially in the manufactured end of the industry, the great preponderance of the domestic load which will remain is a factor that we should not lose sight of. The industrial loads that have been taken on have been carried at a very low margin of profit, if any, by reason of the high costs of fuel and oil necessary to supply them. Thus when the backup takes place, the recovery in operating expense may tend to balance the loss in revenue, especially if we are in a position to develop fully the basic domestic market which will be available at that time.

From all the above, you will see that there is much that our Post-War Planning Committee is considering, and we are hopeful that our activities will enable the industry to plan its course in the future in an intelligent manner.

A. M. Beebee

ALEXANDER M. BEEBEE is well qualified to head the so-called "Baruch Committee of the Gas Industry," whose job it is to map out a blueprint for post-war action. A native of Rochester, New York, Mr. Beebee attended Cornell University, receiving his M.E. degree in Electrical Engineering in 1915. Shortly thereafter, he became associated with the Rochester Railway and Light Company which later became the Rochester Gas & Electric Corporation.

In 1921 Mr. Beebee was appointed assistant superintendent of gas manufacturing, and in 1926 was made superintendent of gas manufacturing, with direction over the research division. He was promoted to become general superintendent of the gas division in 1927, in which position he has supervision over gas manufacturing and distribution, construction work and the research activities of the company.

He has appeared on the lecture platform on many occasions, notably at Massachusetts Institute of Technology, where he lectured for two years before seniors on gas manufacturing problems, his lectures having been published in the leading gas journals. In Rochester, for three years he directed the work of the Massachusetts Institute of Technology Research Field Station.

He has often been consulted on gas problems in all sections of the country and has inspected and reported on gas operations in Johnstown, St. Louis and Terre Haute.

As an active and ardent worker in gas association affairs Mr. Beebee has been chairman of the Carbonization Committee of the American Gas Association and chairman of its committee on the Economics of House Heating. He served for a number of years on the Managing Committee of the Technical Section, becoming vice-chairman in 1938 and chairman in 1939. Other association activities to which he has made valuable contributions have been as a member of the Editorial Committee of the Gas Engineers Hand Book and the Purging Code Committee for Gas Holders.

For the best technical paper presented at a meeting of the American Gas Association, Mr. Beebee was awarded the Beal Medal in 1938 for his contribution, "Time Marches On,—Where Is Manufactured Gas Marching?"

He is a licensed engineer of New York State and a member of the American Chemical Society and the American Standards Association.

Mid-West Sales Managers Meet

J. C. Sackman

THE second roundtable forum for mid-west gas company sales managers, sponsored by the Mid-West Regional Gas Sales Council of the Residential Section, American Gas Association, will be held on April 5, 1943 at the Palmer House, Chicago.

The meeting will feature a war-slanted program including items of particular interest to gas utility companies operating under emergency conditions. Among the subjects to be discussed are:

1. Service and Repair Situation
2. Post-War Planning
3. Customer Survey Activities
4. War Bonds for Future Purchase of Gas Appliances
5. Nutrition Program
6. Limitation Orders
7. CP Range Program
8. Advertising
9. Sales Department Reorganization to Conform With Manpower Situation

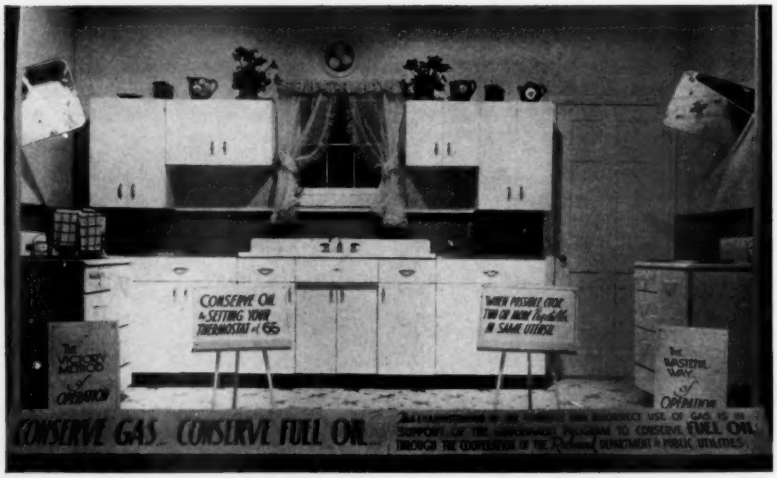
The meeting is under the direction of J. C. Sackman, general sales manager, Northern Indiana Public Service Co., Hammond, Indiana, and Chairman of the Council.

A Post-War Question

ONE of the big problems facing the gas industry when circumstances are more normal is to get the average sale per user moving upwards, which can be done by more fully applying gas to domestic needs for heat. The case for this, on intrinsic merits when viewed from the aspect of national economics, is overwhelming. Advocacy of this policy must never slacken.

A spur to this comes from the danger of present instruction on how to avoid waste of gas, having a boomerang effect on the future. Salvage of that waste can beneficially be applied to improvement of domestic amenities, so making it at least part contributor to them. The present Battle for Fuel stops at salvage, and is only part of the strife for conservation. It's "all-in" twin companion is the substitution of gas for forms of heating which, at best, are anti-conserving, of the nation's heritage.—(*The Gas World*, London, January 16, 1943)

Victory Cooking Technique Displayed



Display window in Richmond, Va., which the gas company utilized to demonstrate the right, or Victory method of cooking as contrasted to wasteful practice

A NOVEL campaign to educate people not to waste gas was conducted recently by the Richmond, Va., department of public utilities, J. R. A. Hobson, Jr., director.

In cooperation with Miller and Rhoads, one of the city's largest department stores, a demonstration was held in the store's Broad Street window from Feb. 1 to Feb. 13. At scheduled intervals a demonstrator, by using show cards, portrayed various points of conservation to be practiced during cooking operations. The right, or Victory method of cooking was dramatically contrasted to the wrong or wasteful method. This feature drew such crowds that police had to be called at intervals to prevent complete blocking of the sidewalk.

In addition to this exhibit, the utility department sent letters to all city employees and schools, industrial and commercial customers, and apartment house tenants, explaining gas conservation methods. Heating customers were visited and asked to fill out questionnaires, giving full information on their heating requirements. The campaign was supported by radio spot announcements, editorials and cartoons in the daily press.

War Production Board officials expressed approval of this activity.

Home Dehydration Methods Studied

HOME dehydration of fruits and vegetables as a practical way to beat the food shortage is gaining attention in the gas industry. Various such methods using equipment available to the average home are being tested in the appliance testing laboratory sponsored by Southern California Gas Company and Southern Counties Gas Company, Los Angeles. H. L. Warren, research engineer is in charge of this activity.

Recently, at a meeting of the home service section of the Pacific Coast Gas Association, Marsten Kimball, assistant county farm advisor in Los Angeles demonstrated a portable dehydrator which is designed to meet the needs of the average family. Constructed of plywood, and about five feet long, this unit is designed to be placed over the top burner of a stove. By means of air circulated by a small fan or a vacuum cleaner blower, it will dehydrate about 15 or 20 pounds of fruits or vegetables at a time, Mr. Kimball said. Priority ratings are being requested so that dehydrators may be commercially produced.

Plans for the dehydrator, which can be made out of any type of wallboard as well as plywood, are being made available through the University of California press. Together with time and temperature tables, the plans can be secured by writing to the Office of the Farm Advisor, 808 South Spring St., Los Angeles, California.

Canadian Gas Sales

SALES of manufactured gas by distributing companies in Canada totalled 1,687,118 M cubic feet during December, 1942, it was reported to the Canadian Gas Association by the Dominion Bureau of Statistics. Of this amount, 760,403 M cubic feet was for domestic use, other than house heating; 473,877 M cubic feet for industrial use; 289,291 M cubic feet for commercial use; 152,957 M cubic feet for house heating, and 10,590 M cubic feet for other uses.

Sales of natural gas during December amounted to 3,416,524 M cubic feet of which 1,814,161 M cubic feet was for domestic use, 920,693 M cubic feet for commercial use, 636,800 M cubic feet for industrial use, and 44,870 M cubic feet for other uses.

Industrial & Commercial Gas SECTION

B. H. GARDNER, *Chairman*
CHARLES G. YOUNG, *Vice-Chairman*
EUGENE D. MILENER, *Secretary*

Industrial and Commercial Gas Conference Reviews War Contributions

Camera shots of the A. G. A. War Conference. At left is the speakers' table at a luncheon meeting, showing Section officers, and Army and Navy representatives. Center is G. E. May, gas air conditioning expert, addressing the conference. Pictured at right is Franklin T. Rainey congratulating C. L. Brockschmidt, WPB Office of War Utilities, on his talk

MEETING in the very heart of the Arsenal of Democracy, the A. G. A. War Conference on Industrial and Commercial Gas, March 11 and 12 in Detroit, covered a wide range of problems bearing on the use of gas in war production, mass cooking and baking for the military and other forces—with a weather eye on post-war phases of industrial and commercial gas development. It was one of the largest gatherings of industrial and commercial gas men ever held, and the rapid-fire schedule of events made up the heaviest two-day program of this type on record.

Engineers, government officials, war production leaders, manufacturers of gas equipment and research workers all contributed to the great pool of valuable information developed at the conference in the form of formal papers, discussion, analysis and questioning.

Army's Views on Gas

The Army's views on gas as a fuel in war production plants were ably presented by Brigadier General Walter B. Pyron, Chief, Fuels Branch, Headquarters Services of Supply, Washington, D. C. General Pyron expressed the hope that a sufficient number of large industrial oil-fired furnaces could be converted to gas this summer so as to save thousands of barrels of critical oil and at the same time utilize available pipe line capacity during the summer. He asked the assistance of industrial gas engineers in helping fuel officers in each of the Army Ordnance Districts to make surveys of war production plants where such change-overs appear practicable. Gen. Pyron was introduced by Lt. Col. R. B. Harris, Chief, Fuel and Power Unit, Detroit Ordnance District, who also outlined some of the fuel problems in connection with war production. Both of these presentations are reproduced elsewhere in this issue.

In his paper "New Applications of Gas in the Aluminum and Magnesium Field" C. George Segeler, chairman of Subcommittee No. 1—Metal Treating and Melting Group, explained the position occupied today in the important aluminum and magnesium fields. This presentation clarified a picture that has long been uncertain and indicated brighter prospects for gas. It was brought out that in the Detroit area 77% of aluminum heat treating is being done with gas, an unexpected figure that is much higher than for the nation as a whole.

J. P. Brosius and F. W. Marklin, of the Metal Treating and Melting Group, analyzed the present status of specialized and furnaceless heat treating of steel with gas and both predicted that this field would grow. The competitive factor with electricity was analyzed both as to the present and the future. Mr. Brosius' remarks appear in full starting on page 162.

C. L. Brockschmidt, chief, Natural Gas Allocation Unit, War Production Board, Washington, D. C. answered a series of questions presented by F. T. Rainey. These questions were designed to clarify government rulings on matters of the supply of industrial and commercial gas under WPB limitation orders.

Harry Holbrook, Heating and Plumbing Division, WPB Washington, D. C., gave a thorough explanation of Limitation Order 182 which covers commercial cooking and baking equipment. Mr. Holbrook was introduced by Roy E. Wright, chairman Food Service Equipment Committee who drove home many points on heavy duty cooking and baking that must be taken into account by our industry in the post-war period.

An analysis of gas war production furnaces was made by E. G. de Coriolis, research director, Surface Combustion, who pointed out trends in industrial gas equipment that are likely to carry over after the war. Mr. de Coriolis' able paper is published in full beginning on page 137.

Dr. F. E. Vandaveer, assistant director, A. G. A. Laboratories gave a detailed, illustrated report on the Industrial Research Committee's project on gas immersion tubes.

A new conception of load factors for industrial and commercial space heating was presented to the conference by Henry O. Loebell, chairman, Industrial and Commercial Space Heating Committee. This interesting study, it is felt, will greatly influence the industry's thought on this subject in the post-war period.

Detroit Output

John W. Batten, vice-president and general manager of the Michigan Consolidated Gas Company and chairman of the Committee on Industrial Gas Research, explained the important part gas is taking in war production in the Detroit area. Mr. Batten stated that over 6% of the total war output in dollar volume is being produced in the Detroit area. Mr. Batten also reviewed industrial gas research and development and

More scenes at the Detroit conference where gas men obtained a firsthand view of gas at work in the Arsenal of Democracy. Flanked by two luncheon pictures is Henry O. Loebell presenting a new conception of load factors for industrial and commercial space heating

its contributions to the war production effort, and projected some of the plans for industrial gas research in the future.

G. Jerry Bartz, plant engineer, Chrysler Corporation, brought a message to industrial gas men from the engineers who have done such an outstanding job of converting American factories to war production. Mr. Bartz was particularly liberal in pointing out the great help that good industrial gas equipment has been and paid a high compliment to the energy and ability of industrial gas engineers who have assisted in the conversion and in keeping furnaces in shape for maximum production.

G. E. May, New Orleans Public Service Inc. who is chairman of the A. G. A. Subcommittee on Gas Air Conditioning Research reviewed his company's wide experiences in air conditioning small commercial establishments. Mr. May presented material that will be helpful to all gas companies planning to enter the gas air conditioning field.

CONFERENCE FEATURES IN THIS ISSUE

In addition to the brief summary of events published here, this issue of the MONTHLY contains the following Detroit Conference papers in full:

	Page
Supply of Gas to War Industries—Brig. Gen. Walter B. Pyron	135
Operation of Limitation Order L-31 in the Ordnance Dep't—Lt. Col. R. B. Harris	136
Equipment Progress—20 Years of Industrial Gas Research and Development—E. G. de Coriolis	137
What the War Period Is Doing to Metal Treating with Gas—John P. Brosius	162
Improving the Outlook for Industrial and Commercial Gas in the Post-War Period—C. V. Sorenson	164

As a means of getting better results from gas ovens used for baking industrial finishes, Harold P. Ransburg of Harper J. Ransburg Co., Indianapolis, Indiana, described a new process for eliminating the bothersome "tears" on dipped metallic parts.

The conference closed with a splendid paper on "Improving the Outlook for Industrial and Commercial Gas in the Post-War Period" by C. V. Sorenson, Northern Indiana Public Service Co., Hammond, Indiana, which is reproduced beginning on page 164.

The meetings were presided over by Ben H. Gardner, Columbus, Ohio and Charles G. Young, Springfield, Mass., chairman and vice-chairman, respectively, of the Industrial and Commercial Gas Section. Manufacturers of industrial and commercial gas equipment each evening entertained those in attendance at the conference. The Program Committee was headed by Hale A. Clark, Michigan Consolidated Gas Company.

What the War Period Is Doing to Metal Treating with Gas

By JOHN P. BROSIUS*

Chairman, A. G. A. Metal Treating and Melting Group

John P. Brosius

WE are in the midst of an industrial production effort of war materials such as the world has never before seen. According to an estimate by the Department of Commerce, 55 per cent of all industrial production in 1942 was for war purposes and the proportion of the country's effort devoted to this purpose is still growing. In the very important metals field, where industrial gas is so extensively used, the percentage devoted to producing war machines is still greater. Thousands, yes even millions, of parts go into these implements of war. The manufacture of high quality, interchangeable parts is the foundation of our mass production system. It is here, in the manufacture of these accurate high quality parts, that industrial gas is perhaps making its greatest contribution to the war production effort. Modern gas furnaces for forging, hardening, annealing, and other heat treatments make it possible for industry to deliver such parts at ever-increasing rates.

Many industrial gas furnaces and ovens of new and special design are being installed to take care of unusual production problems, but of necessity by far the greatest amount of production from gas equipment is in furnaces and ovens, the designs of which were thoroughly tested out before the war started. This has been one of the chief reasons why deliveries of additional industrial gas equipment have not been unduly delayed. On the other hand, where special designs of gas heating equipment have seemed desirable or necessary, the industry has drawn on its store of research and engineering knowledge and quickly produced suitable heating machines that fit admirably into the exacting requirements and are speeding the tempo of our spreading war production plants.

Engineering developments in the metal industries since the defense and war period began were not only large in number but also far-reaching in their ultimate effects. Some of them are having a profound influence on the future of these industries.

The expansion in the production of both aluminum and magnesium has reached proportions not deemed necessary or even possible as little as three years ago. The totals in both cases are many times the output in 1939 or 1940. That the large capacity for producing these metals will have a far-reaching effect on the future of the whole group of metal industries is a probability receiving careful thought. In the A. G. A. Metal Treating and Melting Group gathered here, C. George Segeler, engineer of utilization, A. G. A., is very ably heading a subcommittee compiling data and progress of gas applications pertaining to these two metals and their alloys, and will give a detailed report on some new developments at this conference today.

The tremendous war demand for metals, both ferrous and non-ferrous, has greatly speeded new developments and applications. For example, a serious effort is being made to use gray iron so as to release scarce metals for other war uses. Heat treatment and, in this case, the specialized treatment known today as flame hardening with gas is being practiced on an increasing scale, with the result that gray irons for various engineering applications are being extended into new fields with marked success. While their use in modern war material is still limited, it has been found that, with suitable treatment, gray iron can not only replace steel in certain applications, but it can often replace non-ferrous metals without affecting the functioning of the parts. It is entirely possible for this to become a highly profitable future market for gas heat treating.

What of National Emergency Steels?

Perhaps it is putting it too strongly to say that the development of the National Emergency Steels has placed the alloy steel industry in a radically different position from that occupied before the war.

Presented before A. G. A. Conference on Industrial and Commercial Gas, Detroit, Mich., March 11-12, 1943.

* Equitable Gas Company, Pittsburgh, Pa.

Nevertheless, these steels of low and simple alloy composition are taking a place in industry that is significant as to their effect on the future. It is highly probable that we have seen the last of many uses of the high or complex alloy steels.

The N. E. Steels have some remarkable properties—suspected possibly when they were conceived but demonstrated to be actual as experimentation and trial have proceeded. This is a highly important metallurgical engineering accomplishment. These steels, of course, require heat-treatment to bring out their inherent characteristics and many of these heat-treating techniques and procedures are new.

In addition to the changes in the art of heat treatment necessitated by the need to produce higher alloy steel characteristics in carbon or alloy steels, some further change in the art has been brought about by the increased size and mass of the parts to be treated, together with specifications demanding higher hardness and better physical properties.

The value of steel in many critical applications depends upon its surface. This beauty, as they say, may be only skin deep. But be that as it may, a good "facial" treatment is a prime essential of a mill roll, a bearing, gear, or cam shaft for example. A facial treatment widely used and one in which gas plays a vital part is the procedure of heating the steel to or above a critical temperature and quickly cooling or quenching it.

Advances in Flame Hardening

A gas heating method which is gaining favor, and appears to offer very interesting future possibilities, is at present identified as flame hardening and flame treating, for want of a more descriptive name. This general method fits well into continuous production lines, is ideally suited for surface hardening to a controlled depth, is clean and fast. It appears to be especially suitable for large sizes and spot hardening irregular areas or shapes.

Flame hardening is plainly and simply a heat treatment. It does not add a case to the surface such as in carburizing or nitriding, nor does it add new metal such as the welding process. It does, however, appear to have many advantages, among which are the following:

1. Because carbon is the principal hardening agent in steel, it is possible in many instances to substitute a flame-hardened plain carbon steel or casting for a more expensive and, at present, strategically critical alloy.

2. Objects too large to fit inside a furnace may be readily flame-hardened.

3. It is fast. Hardening may be done in a matter of seconds or a few minutes and is thus geared to fit speedy production lines. A few small pieces or rush orders may be treated without delay.

4. Flame-hardening may be done on finished surfaces after all machining has been completed, thus saving the difficulty and expense of machining a hardened surface.

5. Generally, flame-hardening eliminates or greatly reduces distortion because of the relatively small volume heated compared to the amount of metal remaining cold. Cracking is likewise reduced because of the backing of soft tough metal.

6. Flame-hardening produces a clean smooth surface free from heavy scale or pits.

7. Flame-hardening may be localized. The hardened areas may be made as small or as large as desired and placed only where they are wanted.

8. The hardness may be limited to a shallow case leaving the balance of the metal comparatively unaffected by the application of the heat. Thus, it is possible to heat-treat a casting or forging for desired core properties (ductility, toughness, resistance to impact, etc.) and subsequently harden the surfaces to be exposed to wear.

The use of the open gas flame as a means of heat-treating metals is by no means new. But, after analyzing some of its recent achievements, would anyone with considered judgment today assert that the scope of its possibilities is common knowledge, or that the peak of its usefulness has been reached? Ingenious and specialized methods of timing, directing of highly concentrated heat sources, and indexing coupled with equally ingenious quenching procedures are being devised daily. Each of you will be helping your industry if you make it a point to collect all the information you can on the applications of such processes which may be located in your vicinity and send a copy of this data to F. W. Marklin, Philadelphia Electric Company, Philadelphia, Pa., the very able chairman of our Subcommittee on Furnaceless Heating.

Intent listeners at the A. G. A. War Conference in Detroit

New Industrial Conditions Alter Status of Fuel Costs

The stupendous magnitude of the war program has created a demand for immense quantities of manufactured metallic parts of the highest quality obtainable. It is a program so vast that the supplies of practically all of our metallic resources must be stretched to their limit. Our skilled production personnel must be spread extremely thin, and in many instances replaced with unskilled labor including many women and girls. All of these factors have focused attention upon and speeded the development and application of many advanced type highly mechanized industrial heating operations, where the only operators are unskilled workers and these may be girls.

Does this trend have any significance for us? With hourly labor rates high in relation to manufacturing prices, what effect do you suppose this development may have on total production costs? Is this opening up another field in which the unit price factor of gas or any other fuel is only a side issue? It may be timely to discuss the direction which this phase of metal heating in industry may take. Competitive heat suppliers have been alert to explore the potentialities of such new methods and they are very much awake and stirring now. Perhaps some of us have recent vivid personal experiences attesting to this fact, or did we just shrug it off as of little moment?

Electrolytic Tin Plating

As an example, the new electrolytic tin plating lines come to mind. A new process, you may say, born of the war, due to the scarcity of tin. This is only partially true. The process was conceived several years before the war and development work was well along before we were involved in war. War scarcity of tin provided impetus to speed the conversion to this method at this time. The application of gas to this new method of making tin plate may be decidedly different from the conventional tin pot process. The high speeds of strip travel which are possible, emphasize the desirability and need for closely controlled and highly flexible applications of gas heat. We have the means available and the economies of the process are in our favor but competitive forces are ready and working hard. They will take this market if we are complacent in our attitude or negligent in keeping our customers informed.

. Today, we produce to destroy. But tomorrow, which may not be too far distant, we will produce to build, and we will continue to invent and thus multiply the possessions of our people. We will have at our command vastly increased quantities of materials, many of them new, and much of this material will not be metals. Means will be at hand to perform feats that men have long dreamed of doing. Let us take this principle of gas radiant convection (open-flame) or furnaceless heating by way of illustration. The basic idea or principle is not new. The improvements in flame-hardening have been, obviously, largely confined to technique and equipment. But what an amazing difference this present-day know-how coupled with the better understanding of related tools and processes has made in

the finished products coming off the production line.

Factory Operators Reappraising Gas

Do you think, then, that after the war the gas industry will go back to a period of normalcy, whatever that is? Or do you think it is quite probable that some of these trends now being experienced may materially change the future markets for industrial gas in the metals field?

The research work, the development work and the promotion and interpretation of these developments in the years just past are contributing to the war effort today in a manner in which the gas industry can well take pride. In even greater measure, the development and interpretation of ideas now taking shape will, if handled with prudent foresight, pay dividends to the nation and to the gas fraternity in the post-war years.

The point I wish to particularly emphasize is that in these fevered economic conditions of war time it is more important than ever that the gas companies, for the protection of their own future welfare, be exceedingly diligent in maintaining a full complement of alert and competent industrial gas utilization engineers. Although our mains may be loaded to capacity temporarily, we must not let our managements be lulled into complacency under the mistaken and misguided impression that, since additions to load are not needed now, these services to our industrial and commercial customers can be dispensed with. The facts of the case are just to the contrary.

Improving the Outlook for Industrial and Commercial Gas in the Post-War Period

By C. V. SORENSON*

Northern Indiana Public Service Company, Hammond, Indiana

C. V. Sorenson

THE title of this paper implies a discussion of ways and means to increase the volume of industrial and commercial gas sales and revenues when the war is over. Admitting for the moment the desirability of such a result, we face the question of how it can best be accomplished and in the possible answers lie several points I should like to submit for your consideration as follows:

1. Any attempt to find an answer will involve post-war plans or thinking in some degree. Numerous opinions expressed pro and con on post-war planning indicate the importance of the subject and the amount of thinking being done about it. Without attempting to discuss the broad questions of economics involved in the general subject of post-war planning on a national scale, we can agree that the gas industry will be expected to continue to serve the public when the war is over and we must be prepared to meet the demand.

Must Keep Industry Sound

If we are to be ready to supply gas as and when wanted by the public, and meet the demand for new extensions, pipe lines and added plant capacity, one most important problem is to keep the industry in a sound condition. The one sure way to approach that problem is first to know its kind and size. How much revenue will we lose with the cessation of the war? What change will take place in the percentage each class of revenue will bear to the total? How will this affect our average selling price of gas? Will material and labor costs remain permanently higher? What about taxes? And finally, what about the margin between revenue and operating costs? Will it be smaller as a result of the above and, if so, how much new revenue at what margin will be needed to restore the company to its pre-war stability, and where can the necessary new business be secured?

This may or may not properly be called Post-War Planning, but it is necessary long-range thinking that prudent management must do. The answer to these questions will measure our post-war problem and indicate the kind and size of the plans that will be necessary to produce the desired results, although the details of sales approach may await the proper moment.

2. When management scans the various classes of revenue to determine where post-war increases can be secured, the commercial and industrial departments will be asked what, if anything, they can contribute. There is the school of thought which says that when business is poor, you can't sell more commercial gas to restaurants, because they won't prepare more meals than the public will buy, and that in times of depression, you can't put on a campaign to get the factories to start up just so they will use more industrial gas. Granting those points, there is a more definite way by which these departments can contribute their share. It is a broad approach to the problems of the industry from the angle that the general business life of an area is based upon the industrial activity of that area.

We know that every effort will be made by government and industry to maintain general business activity at a high level after the war. The potential problems of the service cost of the national debt and unemployment resulting from demobilization and release of war workers make such action almost mandatory. Meeting the deferred demands for capital and consumer goods, for new homes, and public works are some of the methods that will be used to hold business at high levels.

But good business nationally will not necessarily carry over into the territory of a given company or even a rather broad area, unless something is done about it and because the commercial and industrial gas men are so close to business and industry they should be of great help, not only to the gas industry and the individual gas company but to industry generally in the territory served by the gas company, in the following manner:

3. Iet us look at the opportunity of the industrial department in an individual territory.

(1) It can determine the general type of industry which exists in the area and what type of business activity will benefit local industry to the greatest extent.

i.e., home building
industrial construction
civic rehabilitation
consumer durable goods
public works, etc.

(2) Determine how probable national business trends will affect the area in question. We know that consumer goods, such as automobiles and refrigerators, will directly affect Detroit and the steel-producing areas. An extensive replacement of railroad cars and motive power would maintain employment in definite areas, and if the post-war home is put on a production line basis, certain other industries and areas will benefit.

(3) What is the industrial man learning from experience with gas in war industries and how can that information benefit local industry?
How has it performed in new applications—what about oven designs and controls? What place will there be for industrial gas in the production of plastics—magnesium and aluminum?

(4) Knowing what industrial gas can do

* Member, A. G. A. Post-War Planning Committee.

and anticipating probable business trends, what will be the normal expectation for gas sales in the area?

(5) If the above does not reflect a satisfactory volume, is there anything the company should do to promote greater industrial diversity in its territory?
Analyze the natural advantages of the territory in question, such as:
labor
natural resources
shipping facilities
availability of markets
housing
schools
Based on these and the probable general industrial trend, can the company help promote industrial activity that is not now common in its area?
This may lead the industrial man somewhat afield from his normal activities, but he is well equipped by training and experience to judge the industrial possibilities of his territory.

4. In an effort to sample the post-war industrial possibilities, one industrial gas engineer was interviewed and the results are most interesting. Without benefit of previous study, he discussed the following interesting facts about the post-war industrial gas market and its problems:

(1) The problem of riveted vs. welded freight cars and pointed out a loss of gas sales if welded construction prevails, but also pointed out that hot forming, if used, would materially increase the use of gas, and further that it should be possible to construct the entire car using the type of construction of the so-called "Murphy" end, thus cutting down weight, speeding output and, incidentally, using more gas in a semi-continuous or roll-type furnace.
(2) Certain types of industry could get into passenger car work and aluminum and magnesium alloys used present problems in melting and heat treating.
(3) Plastics will no doubt be extensively used and the heating of plattens is still a problem.
(4) The advent of lighter metals will greatly change the operations of certain pre-war industries.
One plant was cited as an example. Its pre-war product was widely used in refrigerators and kitchen equipment. The plant has not only converted to war production but is increasing its facilities to include aluminum and magnesium products on war contracts with a view to the post-war possibilities of this type of business. The interest of the industrial gas man is shown in the following:

Pre-war normal gas take.....
.....8 M cu.ft. per hour
Present take.....11 M cu.ft. per hour
Will increase present take to.....
.....31 M cu.ft. per hour

Probably will add heat treating.....
.....10 M cu.ft. per hour
I hear some gas men saying they don't want more load now, but our interest is the post-war period and a change in manufacturing conditions in this case indicates an increase of 5 times in the use of industrial gas by this customer.

(5) In another case, a rotary hearth forging furnace, now being used to produce shell casings (which, by the way, is new load) can be converted to produce airplane engine barrels after the war.
(6) The many changes taking place call for new and improved methods of use such as:
The need for more knowledge about heat treating new alloys.
Steel casting to replace forging and cut down the amount of scrap.
The need of better heat treating to improve the quality of castings.
Infra-red applications which produce a better product than competition.
Spot heating which seems to have some distinct advantages.
The above are the rather quick thoughts of a single engineer and indicate the wealth of ideas available if the entire section were carefully canvassed.
It is quite evident that there is a great deal to be done by the industrial man as an individual in his own company and as a group in this section.

5. The commercial field also presents opportunity for much constructive work some of which can be outlined as follows:

(1) Visit all commercial customers explaining how to make present equipment last and give the best results, and at the same time make a complete market analysis of the commercial field.
(2) During the visit find out what the user demands of his equipment, i.e.,
A. Style or design
Where will it be placed?
Will the customer see it?
Will style help sell its product?
B. Limitations placed by economics and competition on first cost and necessary terms of purchase.
C. Allowable cost of operation (including depreciation).
In terms of cost per unit produced.
D. The work or product it must turn out.
Will it help sell its product easier than competition can?
How must it perform against competition?
E. Accessibility for service and maintenance.
(3) The above data on customer preference and demands could be collected from the member companies by a committee of this section and resolved into a composite for each type of equipment and the number of models or sizes necessary could be determined.
This information passed on to manufacturers would be invaluable in the production of post-war commercial equipment.
A. It will allow the manufacturer to gage more accurately the size and kind of the post-war market.
B. It should give the customer a piece of equipment that will more nearly suit his needs thus increasing his satisfaction with gas as a fuel.
C. It should greatly enlarge the market of the gas company and reduce the cost of sales coverage.
(4) During the visit learn from the customer the requirements placed on fuel used for each job or application where fuel is required and determine if the

C. V. Sorenson addressing the A. G. A. War Conference on Industrial and Commercial Gas in Detroit

business is desirable, and if so—
Review—the necessary rate schedule
the kind and type of equipment available in normal times
necessary man power for territory coverage
required sales and advertising approach
(5) Determine the effect of expansion or contraction of post-war general business on the commercial gas revenues, as an aid to management in making its forecasts.
(6) Determine the customers equipment that will need immediate replacement after the war.
This information should be made available at least in total to manufacturers.
(7) From the above arrive at:
A. Replacement market for worn out and obsolete equipment.
B. Market for replacement of competitive equipment.
C. New equipment market in new establishments if general business continues at present levels or expands.
D. New uses such as air-conditioning, commercial refrigeration, space heating, etc.

6. No effort is made in this discussion to suggest means for securing business that will become evident as a result of such a survey. Such plans are the type that can wait until the end of the war, and perhaps are the type most often referred to when post-war planning is frowned upon.

It is hoped that this paper has succeeded in pointing out the difference between the necessity of measuring the post-war problem and that of setting up the mechanics of selling a product.

When approached in this manner, we find a most important assignment for the members of this section. It seems that rather than telling you in glowing terms of the sales opportunities when the war is over, the industry is asking your help in analyzing and placing a set of conditions different by far than we have ever faced before.

Yes, our first task is to win the war—to turn out the most and best equipment in order to end the war quickly and save as

many lives as possible; so we may be free to choose our own way of life; and argue over politics and predict that things are going to change; to use our improved skills to provide better goods for ourselves in the post-war period and to provide labor and a living for all; and finally when the day of victory comes, the American public will expect the gas industry to continue expanding and improving its service as it always has done in the past.

SUPPLY OF GAS TO WAR INDUSTRIES

(Continued from page 136)

alleviate existing conditions, foremost among which are:

a. Converting plants using fuel oil to the use of gas, during the summer months; thereby, permitting a build-up of oil and coal stocks prior to the winter season.

b. Make the maximum use of all existing facilities for fuel handling and burning equipment to save the drain on critical materials.

c. Insofar as it is possible, build up storage of gas in underground reservoirs to be used during the next winter season.

In the matter of conversions, this will require close coordination with all agencies concerned with fuel, fuel oil, coal, natural gas, and manufactured gas, and must take into consideration the amount of critical materials involved in conversion, and the shut-down time that will be involved in converting critical plants.

We are in a war, and a very serious war—the winning of the war should be uppermost in the minds of all of us; therefore, in approaching these problems, we should lay aside all selfish motives and post-war positions, that will, in any wise, delay or interfere with the prosecution of the war. When we have won the peace, you can then, I am sure, readjust your business to meet the conditions that exist at that time.

You may be assured that the Armed Services are fully aware of the many problems involved in supplying the Armed Services, essential industries and civilians with fuel, and are cooperating fully with all Governmental agencies who are directing the production, distribution, and utilization of fuel. I should like to quote an excerpt from a letter dated February 22, 1943, from Mr. Krug, Director of Office of War Utilities, addressed to Robert Allen, Assistant Deputy Petroleum Administrator for War: "The office of War Utilities will release off-peak natural gas for fuel oil replacement on application from consumers engaged in war industry and essential civilian activities."

It is particularly pleasing to learn that in the city of Detroit, where industry has done such an outstanding job of converting many plants to war production, industry has already arranged for the conversion of eight large plants from the use of fuel oil, to off-peak natural gas service. The initial conversions, of which we have a record, will provide 300,000 barrels of additional fuel oil annually for other uses. Through the efforts of the group here represented, and other interested agencies, it should be possible to multiply this quantity greatly throughout the nation.

In closing, I wish to assure you of my pleasure in meeting with you and learning at first hand some of the problems of your industry. By your attendance at this War Conference of your Association, you are evidencing a sincere desire to participate to an even greater extent in the war effort. You may be assured that the Armed Services will cooperate with you in your efforts to help solve a critical and vitally important condition facing our nation.

INDUSTRIAL AND COMMERCIAL GAS ADVERTISING FOR APRIL

The National Advertising Committee of the Industrial and Commercial Gas Section, J. P. Leinroth, chairman, and F. B. Jones, vice-chairman, announces that full page advertisements will appear in the trade and business magazines listed below during the month of April. These advertisements are prepared in cooperation with the Committee on National Advertising as a part of the industry's national advertising campaign.

MAGAZINE	THEME
General Business and Manufacturing	
BUSINESS WEEK (Apr. 10)	Take the "Kinks" out of your production! Look to the Industrial *GAS* Engineer for help.
Metals Industry	
THE IRON AGE (Apr. 22) INDUSTRIAL HEATING METALS AND ALLOYS	"Seems like GAS Does Everything!"
Ceramic Industry	
GLASS INDUSTRY	*Versatile* is the role of GLASS in wartime!
Hotel Field	
HOTEL MANAGEMENT	Good food helps "Keep 'em flying." In war plants everywhere *GAS* cooking means good nutrition.
Hospital Field	
MODERN HOSPITAL	Talk about good nutrition—it *started* in our hospitals!

Manhole Cover Standards

AN American Standards Association publication, A35.1-1941, covering "Manhole Frames and Covers for Subsurface Structures," has been made available at 35¢ per copy. It represents the culmination of standardization work on manhole frames and covers started in 1924 under ASA procedure and contains specifications covering the design, material and dimensions of such covers, except those used for electric supply and gas services.

The designs adopted as standard are believed to be suitable for the use of those who have no satisfactory designs of their own or who may desire to avoid additional expense involved in the purchase of special patterns.

Joint sponsors of the work were the A.S.A. Telephone Group and the American Society of Civil Engineers. The American Gas Association was represented on the sectional committee by J. H. Braine, formerly engineer of distribution, The Brooklyn Union Gas Company.

GAS INDUSTRY IN THE NEXT LIFE

"Unfortunately, present-day conditions make it impossible for us to operate such a scheme, which would entail a large staff of competent 'Gas Service Engineers.' We are, however, preparing for the world to come. . . . ."—Circular letter from a gas company, recorded by *Punch*, London.

Distribution Conference in Cincinnati To Clarify Wartime Operating Problems

H. B. Andersen

THE extraordinary problems of gas distribution in a country at war will be subjected to expert and concentrated attention at the twentieth annual Distribution Conference of the American Gas Association which takes place April 29 and 30 at the Netherland Plaza in Cincinnati, Ohio. Meeting under conditions unmatched in the history of conference, this gathering will attempt to clear up any bottlenecks of gas supply which may exist in the vast network of pipelines which serve industry and home. It will review manpower and material shortages, government regulations and the myriad of new practices which have been dictated by war.

Luncheon Meetings Stressed

A program committee headed by the Distribution Committee officers, Chairman H. B. Andersen, Philadelphia Gas Works Co., and Vice-Chairman A. C. Cherry, Cincinnati Gas and Electric Co., has prepared a program flexible enough to include all latest developments. Special emphasis is being placed on the four luncheon conferences at which numerous subjects will be discussed informally. These conferences will be divided as follows:

Thursday afternoon, April 29—"Pipe Coatings and Corrosion," R. F. Hadley, Susquehanna Pipe Line Co., Philadelphia, chairman, and "Work on Customers' Premises," W. T. Collins, Ohio Fuel Gas Co., Columbus, chairman; Friday afternoon, April 30—"Meters and Metering," J. H. Collins, New Orleans Public Service Inc., New Orleans, chairman, and "Construction and Maintenance," T. H. Kendall, Equitable Gas Co., Pittsburgh, chairman. Subjects to be discussed at these roundtable meetings range from the use of women in distribution work to reconditioning and reclaiming pipe lines, in addition to which there will be progress reports on A. G. A. research projects.

The panel discussions for the second morning will include a striking wartime presentation by the "Father of the Distribution Committee," J. D. Von Maur of Toronto.

James G. Stewart, Mayor of Cincinnati, and H. C. Blackwell, president of the Cincinnati Gas & Electric Co., will welcome the delegates to Cincinnati and discuss the local industry situation. This will be followed by a practical operating man's report on Cathodic Protection Interference presented by A. V. Smith, of Philadelphia, nationally recognized consulting engineer. The Thursday morning session will conclude with a timely address on feminine infiltration into distribution work by Frank S. Williams,

W. T. Collins

T. H. Kendall

Columbus District Manager, Ohio Fuel Gas Company.

An outstanding feature of the Friday morning session will be the showing of the pipe line film, "The Story of 'Big Inch,'" a dramatic color movie of actual construction of the world's largest oil pipe line. The distribution men will have the distinction of viewing the premier of this film which subsequently will be shown in various parts of the United States.

An important segment of the program will be devoted to public utility motor vehicle transportation, which has been drastically affected by regulations of the Office of Defense Transportation. The Committee on Operation of Public Utility Motor Vehicles will be represented by F. A. Heinlein, Cincinnati Gas and Electric Co., who will bring the conference up-to-date on recent directives and interpretations as well as the latest utility practice.

One of the most valuable events is expected to be the panel discussion on emergency problems which will open the Friday session. This discussion will include a variety of topics such as servicing, personnel and substitute materials. There will also be a paper on "Teaching Customers To Do Things for Themselves as an Aid to the War Effort."

A. C. Cherry

Following is the schedule of events:

THURSDAY, APRIL 29

10:00 A.M.

Chairman's Opening Remarks. H. B. Andersen

Welcome by Mayor James G. Stewart and H. C. Blackwell, President of The Cincinnati Gas & Electric Company

Greetings from A. F. Bridge, President, American Gas Association and Major Alexander Forward, Managing Director, American Gas Association

Cathodic Protection Interference. A. V. Smith, Consulting Engineer, Philadelphia, Pa.

Women in Distribution Work. Frank S. Williams, Columbus Dist. Mgr., Ohio Fuel Gas Company, Columbus, Ohio.

12:30 P.M.

Round Table Luncheon Conferences

Luncheon No. 1

Pipe Coatings and Corrosion. R. F. Hadley, Chairman, Susquehanna Pipe Line Co., Philadelphia, Pa.

Luncheon No. 2

Work on Customers' Premises. W. T. Collins, Chairman, Ohio Fuel Gas Co., Columbus, Ohio, including Women in the Gas Industry and Employee Training

FRIDAY, APRIL 30

9:30 A.M.

Panel Discussion on Emergency Problems, including Servicing under Pres-

ent Conditions, Personnel, and Substitute Materials

Teaching Customers To Do Things for Themselves as an Aid to the War Effort

Motor Vehicles Operation at the Present Time. A contribution by the Committee on Operation of Public Utility Motor Vehicles

Pipe Line Film

The Story of "Big Inch"—The World's Largest Pipe Line for Oil (First showing)

12:30 P.M.

Round Table Luncheon Conferences

Luncheon No. 1

Meters and Metering. J. H. Collins, Chairman, New Orleans Public Service Inc., New Orleans, La., including Tin Conservation and the Solder Situation

Luncheon No. 2

Construction and Maintenance. T. H. Kendall, Chairman, Equitable Gas Co., Pittsburgh, Pa., including Servicing questions generally and Reconditioning and Reclaiming Pipe Lines

Production and Chemical Conference To Be Held May 25-26

FOLLOWING the annual meeting of distribution men by one month, the Joint Production and Chemical Committee Conference of the American Gas Association will be held at the Hotel Pennsylvania, New York, N. Y., Monday and Tuesday, May 24 and 25. This conference will spotlight new chemical developments and refinements in gas production which have resulted from the war. The program will include reports on A. G. A. research projects as well as authoritative papers on gas production, maintenance and repair problems.

In addition to two morning business sessions, the conference will include three roundtable luncheon meetings at which information on specialized problems will be exchanged and a general war emergency luncheon conference which will give a bird's eye view of the industrywide situation. Tuesday luncheon meetings are scheduled as follows: Water Gas—P. T. Dashiell, chairman; Chemistry in Industry—Dr. F. H. Dotterweich, chairman; and Coal Carbonization—A. C. Sedlachek, chairman.

A feature of the conference will be a post-war symposium conducted by A. M. Beebee, chairman of the A. G. A. Post-War Planning Committee.

E. W. Zimmerman, Eastern Gas and Fuel Associates, Everett, Mass., chairman of the Gas Production Committee and T. L. Robey, Washington Gas Light Co., Washington, D. C., chairman of the Chemical Committee, will alternate as presiding officers.

The tentative program follows:

MONDAY, MAY 24

10:00 A.M.

Chairman's Opening Remarks. E. W. Zimmerman

Greetings. Alexander Forward, Managing Director, American Gas Association

Address. E. R. Acker, Chairman, A. G. A. Committee on War Activities

Two-Shell Water Gas Set. D. S. Reynolds, Vice-President, Boston Consolidated Gas Co., Boston, Mass.

Approved Apparatus for Rapid Determination of Traces of Carbon Monoxide. Louis Shnidman, Lab. Dir., Rochester Gas & Electric Corp., Rochester, N. Y.

Report on Organic Sulphur Research. Dr. E. W. Guernsey, Chairman, Subcommittee on Organic Sulphur, A. G. A.

1:00 P.M.

Round Table Luncheon Conferences

Luncheon No. 1

Water Gas. P. T. Dashiell, Chairman, Vice-President, The Philadelphia Gas Works Co., Philadelphia, Pa.

Luncheon No. 2

Chemistry in the Gas Industry. Dr. F. H. Dotterweich, Chairman, Texas College of Arts and Industries, Kingsville, Texas

Luncheon No. 3

Coal Carbonization. A. C. Sedlachek, Chairman, Philadelphia Coke Co., Philadelphia, Pa.

TUESDAY, MAY 25

9:30 A.M.

Chairman's Opening Remarks. T. L. Robey, Post-War Symposium. A. M. Beebee, Presiding, Chairman, A. G. A. Committee on Post-War Planning

Reports of Committee Chairmen on the Four Basic Studies:

Post-War Purchasing Power and Potential Markets. C. V. Sorenson, Supervisor of New Business, Northern Indiana Public Service Co., Hammond, Ind.

Factors Affecting the Realization of the Potential Markets. R. J. Rutherford, Vice-President, Worcester Gas Light Co., Worcester, Mass. and R. E. Ginna, Assistant to President, Rochester Gas & Electric Corp., Rochester, N. Y.

Engineering and Economic Aspects of Our Own Ability to Satisfy the Potential Markets. Hall M. Henry, NEGEA Service Corp., Cambridge, Mass.

Effects of National Planning and Trends. Walter C. Beckjord, Vice-President and General Manager, Columbia Gas & Electric Corp., New York, N. Y.

Nitric Oxide Removal at Boston

Maintenance and Repairs During the Emergency

Reformed Gas Oil

Gas Enrichment

12:30 P.M.

Luncheon Conference on War Emergency including, "How the gas industry personnel is to be rated and regarded"—by a representative of the A. G. A. Committee on Personnel Practices.

Motor Vehicle Committee Conference

Linn Edsall

CHAIRMAN LINN EDSALL, Philadelphia Electric Company, Philadelphia, Pa., announces that the Technical Section's Motor Vehicle Committee has arranged a one day conference to be held May 4 at the Hotel Pennsylvania in New York. The convenience of many members was considered in selecting the time and place; it precedes the Society of Automotive Engineers meeting scheduled for May 5 and 6.

The vice-chairman of the committee, E. W. Jahn, Consolidated Gas Electric Light and Power Company of Baltimore, is program chairman with a committee consisting of J. R. North, Consumers Power Co., Jackson, Michigan and H. A. Peterson, American Gas and Electric Service Corp., New York, N. Y.

Among the matters scheduled for presentation are rationing and restrictions and current operating transportation problems. Further details will be announced later.

As noted elsewhere in this issue the committee is presenting a paper on the Technical Section Distribution Conference Program in Cincinnati.

Co-ed Version

THE following co-ed version is the result of an inspection trip, as reported in *Pacific Service News:*

"We went through the whole plant the other day and we know all about the gas business. The generator purifies the scrubbers and then runs down the transmission mains, and then blows up the holder. The holder sifts the fumes into the mains and the mains serve it to the meters. The meters, bless their little throbbing hearts, breathe deeply and register the bad news for the consumer."

Short-Cut Procedures
FOR ANALYSES AND TESTS

Compiled by the Chemical Subcommittee on Analyses and Tests
Dr. Channing W. Wilson, Chairman

THE following procedures initiate the publication of a series of time-saving analytical and test procedures, which, it is hoped, will find wide application in manufacturing plants and laboratories of the industry. We are faced with keeping up our standards of production and quality in spite of the continuing curtailment of personnel and the consequent increased burdens placed upon those remaining.

The notice published in the March issue of the MONTHLY is producing results, and we hope to have available for those interested an increasing number of short-cut methods of test and analyses. We may not be able to publish them all in this journal, but every effort will be made to give them as wide distributiton as possible. If you have devised similar time-saving means, please forward a short description to the Subcommittee on Analyses and Tests, in care of the American Gas Association, 420 Lexington Avenue, New York.

The following notes were contributed by J. E. Brewer. Some have been published before, others are made available for the first time. They appear to offer means of evaluating some fuels, at a considerable saving of time. The procedures are not meant to replace standard methods, but are substitutes to approximate the desired information when it is impossible to carry out the standard tests. The Subcommittee cannot assume responsibility for them, but suggests that they may be of aid to you in your operations, with the realization that they are substitutes for standard methods.

SHORT-CUT PROCEDURES FOR EVALUATING SOME FUELS

J. E. BREWER

Calorific Value of Bituminous Coal

The following method for calculating the calorific value of bituminous coals gives fair results. The origin of the data is not recalled.

100 — (ash plus moisture) = A
(Fixed carbon + A) × 100 = B
Refer B to Table
B.t.u. in table × A =
B.t.u. per lb. as received.

TABLE
For Calculating B.t.u.'s

B	*B.t.u.*	*B*	*B.t.u.*
100.0	14,500.00	82.0	15,788.60
99.5	14,543.17	81.5	15,801.40
99.0	14,586.33	81.0	15,814.20
98.5	14,629.50	80.5	15,827.00
98.0	14,672.67	80.0	15,840.00
97.5	14,715.84	79.5	15,828.75
97.0	14,760.00	79.0	15,817.50
96.5	14,820.00	78.5	15,806.25
96.0	14,880.00	78.0	15,795.00
95.5	14,940.00	77.5	15,783.75
95.0	15,000.00	77.0	15,772.50
94.5	15,060.00	76.5	15,761.25
94.0	15,120.00	76.0	15,750.00
93.5	15,165.00	75.5	15,738.75
93.0	15,210.00	75.0	15,727.50
92.5	15,255.00	74.5	15,716.25
92.0	15,300.00	74.0	15,705.00
91.5	15,345.00	73.5	15,693.75
91.0	15,390.00	73.0	15,682.50
90.5	15,435.00	72.5	15,671.25
90.0	15,480.00	72.0	15,660.00
89.5	15,510.00	71.5	15,637.50
89.0	15,540.00	71.0	15,615.00
88.5	15,570.00	70.5	15,592.50
88.0	15,600.00	70.0	15,570.00
87.5	15,630.00	69.5	15,547.00
87.0	15,660.00	69.0	15,524.50
86.5	15,672.90	68.5	15,502.00
86.0	15,685.80	68.0	15,480.00
85.5	15,698.70	63.0	15,120.00
85.0	15,711.50	60.0	14,580.00
84.5	15,724.40	57.0	14,040.00
84.0	15,737.20	54.0	13,320.00
83.5	15,750.10	51.0	12,600.00
83.0	15,762.90	50.0	12,240.00
82.5	15,775.70		

Calorific Value of Coke

The calorific value of coke may be calculated quite satisfactorily from the following formula found in "American Fuels" by Bacon and Hamor.

Per cent combustible × 80 =
calories per gram.
Calories per gram × 1.8 = B.t.u.'s per lb.

Calorific Value of Petroleum Products

This may be very accurately calculated from the following formula found in the Bureau of Standards Miscellaneous Publication No. 97—"Thermal Properties of Petroleum Products."

12400 — (2.100 × gravity squared) =
calories per gram.
Calories per gram × 1.8 = B.t.u.'s per lb.

Evaluating the Enriching Properties of Light Gas Oils

The Mighill Analysis, as described in "A. G. A. Proceedings," 1930, page 1201-4, is a fair substitute for the Laboratory Cracking Test for evaluating light gas oils; it is worthless for crude oils, residuum oils and heavy oils.

In making the Mighill Analysis it has been found that the determination of Naphthenes, which is the most difficult and time-consuming part of the analysis, may be omitted and the following factors used without materially affecting the results:

Olefins × 0.25
Aromatics × 0.50
Naphthenes + Paraffins × .931

The factor for Naphthenes and Paraffins has been worked out by Paul E. Reichardt, Chemist of the Washington Gas Light Company, who has checked numerous analyses of light gas oils to determine this factor.

Nitric Oxide Determination

A SIMPLIFIED apparatus for use in determining nitric oxide in gases has been described by Louis Shnidman in the American Gas Association Proceedings for 1942. The apparatus is easily assembled and portable, and the procedure requires a minimum of materials, time, and attention by the operator.

Reprints of this article are available and may be secured upon request to the office of the Technical Section of the Association.

Carbonization Study of Kansas Coal

IN its program of promoting efficient utilization of coal for the war, the Bureau of Mines has completed a study which reveals that a high-sulphur, high-volatile coal from Kansas can be used to produce coke for making water gas (illuminating gas), Dr. R. R. Sayers, director of the Bureau of Mines, revealed recently.

Prior to the Bureau's research, many persons believed that the coal from the Bevier bed of Crawford County, Kan., could not be used in the slot-type coke ovens without damaging equipment. However, the tests were conducted successfully in both the slot-type (Koppers) ovens and the flat type (Curran-Knowles) ovens, Dr. Sayers said in referring to a report prepared by Bureau chemists.

Coke produced in the Curran-Knowles ovens was utilized in the production of water gas, but the research disclosed that it is not advisable to feed the coke in water gas generators using mechanical grates because of the low softening temperature of the coke ash and the readiness with which it liquefies.

Although the water gas produced by the coke contained high percentages of hydrogen sulphide and organic sulphur, Bureau chemists said these undesirable materials can be removed.

Copies of the report may be obtained by writing the Bureau of Mines, Department of the Interior, Washington, D. C., for Report of Investigations 3671, "Carbonization of Bevier Bed Coal from Kansas and Production of Blue Water Gas from the Resulting Coke," by W. W. Odell.

Laboratories

GEORGE E. WHITWELL, *Chairman*
R. M. CONNER, *Director*
F. A. ALLEN, *Supervisor, Pacific Coast Branch*

Predicting Spillage Characteristics of Water Heater Draft Hoods

New Formulae Developed for Calculating Minimum Vertical Stack and Maximum Horizontal Flue Run to Avoid Spillage

By MILTON ZARE
American Gas Association Testing Laboratories

APPROVAL and installation standards for domestic gas appliances have always devoted special attention to construction and performance features of draft hoods. The important part which such accessories contribute toward satisfactory and safe operation of the equipment on which they are mounted fully justifies this stand.

Draft hoods in general are required to function under a wide variety of operating conditions. While temporary flue or chimney stoppages and downdrafts or updrafts of varying intensity probably impose the most severe conditions, these are usually of rather infrequent occurrence. On the other hand the possibility of "spillage" or escape of flue products through draft hood relief openings is always present under normal conditions of operation. Much study has been devoted to the preparation of adequate performance tests to insure that spillage would be minimized as far as possible. Naturally the extent to which it occurs is dependent upon a number of factors.

In addition to design features of the individual draft hood employed, special consideration must be given to the effective height of vertical stack above the relief opening. Length of horizontal flue connection is also a major factor. For purpose of approval testing of water heaters, spillage tests have always been conducted using four feet or more of stack above the draft diverter. Following the policy of constantly strengthening testing procedures, consideration was recently given to reducing the height of stack employed with the thought of thereby avoiding any possible difficulties with spillage of flue gases under more severe operating conditions.

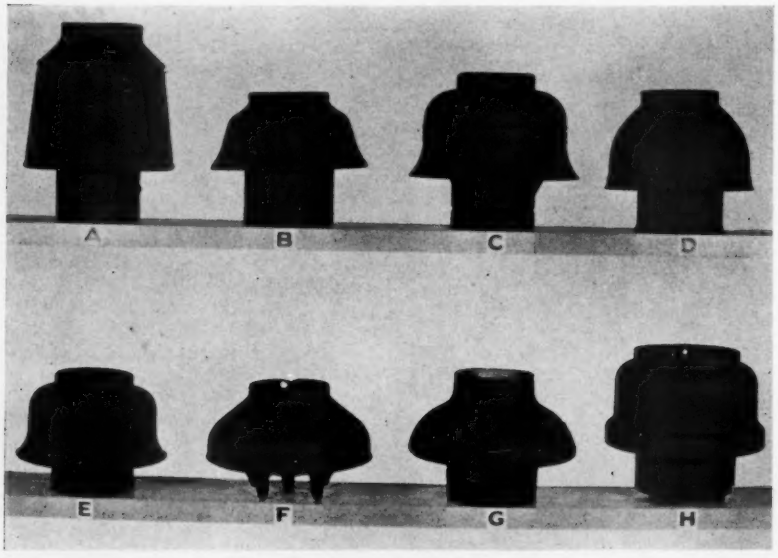


Fig. 1. Representative types of water heater draft hoods employed in these studies of flue gas spillage from relief openings of draft hoods

An investigation was therefore undertaken in which upwards of 30 contemporary models of automatic storage water heaters, employing various types of draft hoods, were used. It was found that approximately three-fourths of those employed could operate without spillage through the draft hood relief openings when a minimum of three feet of vertical stack was provided. During the course of this investigation, extensive data were obtained on the performance of various type heaters and draft hoods under different stack conditions.

As a part of this study, empirical formulae for evaluating and predicting spillage characteristics of heaters under specified test conditions were developed, using theories and data on flow of gases. The first of these formulae is given below:

$$H = K\left[\frac{R}{D^2\,CO_2}\right]^2$$

Where:

H = height of vertical stack required to prevent spillage (measured from bottom of draft hood skirt to top of stack), inches
K = constant (characteristic of each type of draft hood),
R = input rating, 1,000 B.t.u. per hr.,
D = diameter of draft hood outlet (and stack), inches, and
CO_2 = per cent CO_2 in flue gases entering draft hood.

Under the conditions employed in the derivation of this formula, it is only applicable to water heaters of input ratings below 4,000 B.t.u. per hour per square inch of draft hood area operating on test natural gas available at the American Gas Association's Cleveland Laboratories. Nevertheless it indicates the possibilities for calculating and predicting spillage characteristics of draft hoods on various types of gas appliances. By further study, a formula which would be generally applicable could no doubt be developed. It must also be recognized that the formula shown above applies only to the height of vertical stack and does not give consideration to certain other flue conditions which exert an im-

portant influence on performance of heaters in service. The study was therefore continued for the purpose of establishing means of calculating the maximum length of horizontal flue pipe which could be employed under set conditions without causing spillage. A second empirical formula was accordingly derived and is given below:

$$L_h = K\,D\left[\left(\frac{D^2\,CO_2}{R}\right)^2 - K_1\right]$$

L_h = maximum length in feet of horizontal flue pipe that may be connected between draft hood outlet and 4 feet of vertical stack with 2 standard 90° elbows without causing spillage, and

K, K_1 = constants depending on draft hood design

Experimental data were also secured on representative heaters equipped with a variety of designs of draft hoods to check values calculated by application of the two formulae given. Draft hoods employed, which included those of the standard A. G. A. cone type, are illustrated in Figure 1. Close agreement was obtained throughout with the calculated figures. As a large number of water heaters of contemporary design were employed, the reliability of these formulae for the purpose for which they were developed may be regarded as amply demonstrated. Considering the importance of satisfactory and effective venting of gas appliances, it is believed that a discussion of the derivation of these formulae will be of interest to those engaged in the design and installation of gas-burning equipment.

Difference in Pressure

Flow of gases through a chimney depends on difference between pressure existing at the base of chimney and that of surrounding air. This difference in pressure may be calculated from difference in weight per cubic foot (density) of the flue gases in the chimney and surrounding air. Difference in pressure exerted at base of stack H inches high by air and flue gases at their respective temperatures T_1 and T_2 is:

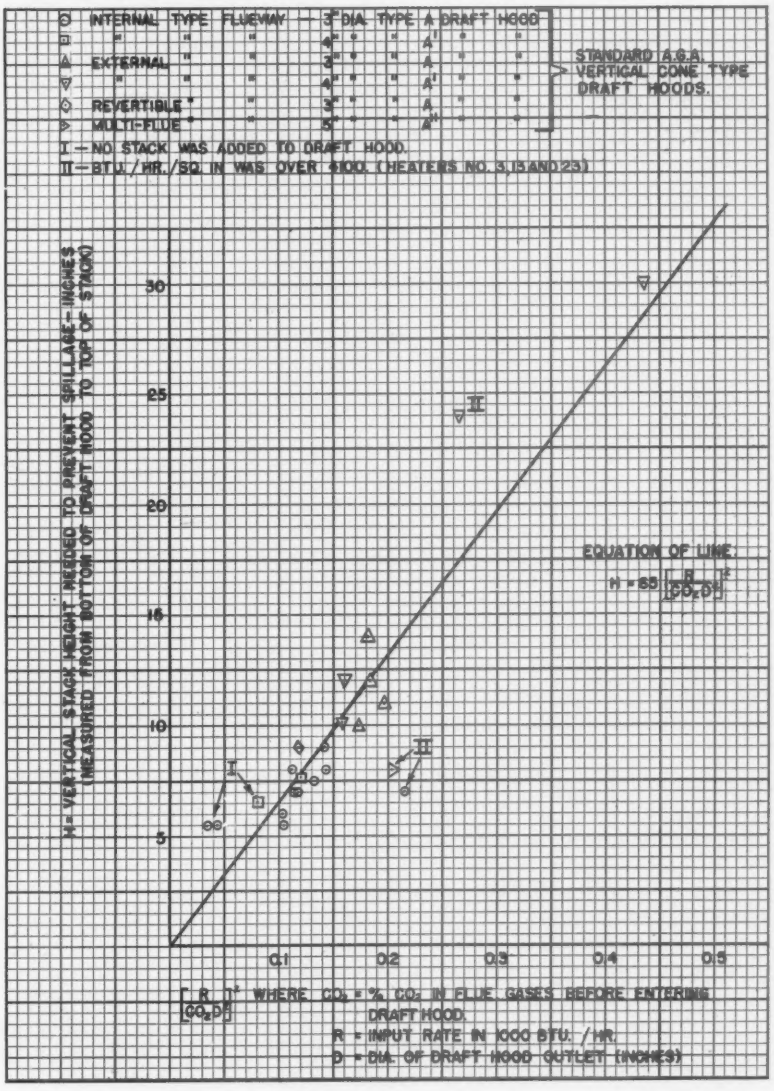

INTERNAL TYPE FLUEWAY — 3" DIA. TYPE A DRAFT HOOD
EXTERNAL " " " 3" " " A'
" " " " 4" " " A'
REVERTIBLE " " " 3" " " A
MULTI-FLUE " " " 5" " " A''
STANDARD A.G.A. VERTICAL CONE TYPE DRAFT HOODS.
I — NO STACK WAS ADDED TO DRAFT HOOD.
II — BTU. / HR. / SQ. IN. WAS OVER 4000. (HEATERS NO. 3, 15 AND 23)
H = VERTICAL STACK HEIGHT NEEDED TO PREVENT SPILLAGE — INCHES (MEASURED FROM BOTTOM OF DRAFT HOOD TO TOP OF STACK)
EQUATION OF LINE:
H = 85 [R / (CO2 D2)]2
0.1
0.2
0.3
0.4
0.5
[R / (CO2 D2)]2 WHERE CO2 = % CO2 IN FLUE GASES BEFORE ENTERING DRAFT HOOD.
R = INPUT RATE IN 1000 BTU. / HR.
D = DIA. OF DRAFT HOOD OUTLET (INCHES)

Fig. 2. Relation between $\left[\frac{R}{CO_2\,D^2}\right]^2$ *and height of stack needed to prevent spillage with type A, A' & A'' draft hood when utilizing natural gas*

$$P_{air} - P_{flue\ gas} = H(0.0765)\left(\frac{520}{T_1}\right)\left(\frac{B}{30}\right) - HS(0.0765)\left(\frac{520}{T_2}\right)\left(\frac{B}{30}\right)$$

$$= 0.0765\left(\frac{520}{30}\right)BH\left(\frac{1}{T_1} - \frac{S}{T_2}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

H = height of stack, inches,

T_1 = temperature of air, °F. absolute,

T_2 = mean temperature of stack gases, °F. absolute,

S = specific gravity of stack gases at standard conditions (air = 1), and

0.0765 = weight per cu.ft. of air at standard conditions.

This difference in pressure causing flow of flue gases may be expressed in terms of "velocity head" of stack gases at the average temperature in chimney and at atmospheric pressure as follows:

$$P_{air} - P_{flue\ gas} = h_v\,S(0.0765)\left(\frac{520}{T_2}\right)\left(\frac{B}{30}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where:

h_v = velocity head, inches

From equations (1) and (2)

$$h_v = \frac{H\left(\frac{1}{T_1} - \frac{S}{T_2}\right)}{\frac{S}{T_2}} = H\left(\frac{T_2}{ST_1} - 1\right) \quad (3)$$

Substituting this value for h_v in the fundamental equation for frictional flow of fluids, the following is obtained:

$$V = \left[\frac{2g}{12}\,(h_v - h_f)\right]^{1/2} = \left(\frac{2g}{12}\right)^{1/2}\left[H\left(\frac{T_2}{ST_1} - 1\right) - h_f\right]^{1/2} \quad (4)$$

Where:

V = velocity, ft. per second

g = acceleration due to gravity, 32.2 ft. per second,

h_v = velocity head, inches, and

h_f = frictional velocity head loss, inches of water.

Friction between moving gases and pipe surfaces and internal friction between gas molecules causing a loss of velocity head, may be expressed as follows:

$$h_f = \frac{K_1 V^2}{T_2} \sum f \frac{L}{D} \quad \ldots\ldots\ldots\ldots (5)$$

Where:

K_1 = constant
L = length of each flueway section, inches,
D = diameter of each flueway section, inches, and
f = coefficient of friction of each section.

For a draft hood and vertical stack connected to a water heater equation (5) becomes:

$$h_f = \frac{K_1 V^2}{T_2} \left(f_d \frac{L_d}{D_d} + f_v \frac{L_v}{D_v} \right) \ldots (6)$$

Where:

f_d = coefficient of friction of draft hood,
f_v = coefficient of friction of vertical pipe,
L_d = effective length of flueway through draft hood, inches
L_v = length of vertical pipe, inches,
D_d = effective diameter of flueway through draft hood, inches, and
D_v = diameter of vertical pipe, inches.

Assuming that the ratio $\frac{L_d}{D_d}$ will be constant for any single type of draft hood and the main frictional loss is in the draft hood (i.e. $f_v \frac{L_v}{D_v}$ is very small compared to $f_d \frac{L_d}{D_d}$ for the length of stack employed in spillage tests) equation (6) may be simplified to:

$$h_f = K_1 \frac{V^2}{T_2} (f_d K_3) = \frac{K_2 V^2}{T_2} \quad \ldots\ldots (7)$$

Where:

K_2 = assumed constant for $\frac{L_d}{D_d}$ and $f_v \frac{L_v}{D_v}$, and K_3 = combined constant for K_1 and K_2.

Substituting this value in equation (4) and solving for H:

$$V = \left(\frac{2g}{12}\right)^{1/2} \left[H \left(\frac{T_2}{ST_1} - 1 \right) - \frac{KV^2}{T_2} \right]^{1/2}$$

$$H = \frac{C_1 V^2 \left(1 + \frac{C_2}{T_2} \right)}{\left(\frac{T_2}{ST_1} - 1 \right)} \quad \ldots\ldots\ldots\ldots (8)$$

Where C_1 and C_2 = constants resulting in elimination of $\frac{2g}{12}$ and K.

Employing the method of calculating flue gases in cubic feet per hour presented in Bulletin No. 10—"Research in Fundamentals of Atmospheric Gas Burner Design" it was possible to determine the velocity, V, of the flue gases for Cleveland natural gas as follows:

$$Q = \frac{R_1 T_2}{520 \times 100} \left[104 + 0.94 \left(\frac{12.2 - CO_2}{CO_2} \right) 0.90 \right]$$

Where:

Q = volume of flue products, cu.ft. per hr.,
R_1 = input rating, B.t.u. per hr., and
CO_2 = carbon dioxide concentration in flue products, per cent.

Then:

$$V = \frac{Q}{\text{area of draft hood}} = \frac{Q}{\frac{\pi D^2}{4}} = \frac{K_4 R_1 T_2}{D^2}$$

$$\left[1.04 + 0.94 \left(\frac{12.2 - CO_2}{CO_2} \right) 0.90 \right] \ldots (9)$$

Where:

K_4 = constant eliminating (520 x 100) and $\pi/4$

Substituting this value of "V" in equation (8)

$$H = \frac{K_5 R_1^2 T_2^2 \left[1.04 + 0.94 \left(\frac{12.2 - CO_2}{CO_2} \right) 0.90 \right]^2 \left(1 + \frac{K_2}{T_2} \right)}{D^4 \left(\frac{T_2}{ST_1} - 1 \right)} \quad \ldots\ldots\ldots\ldots (10)$$

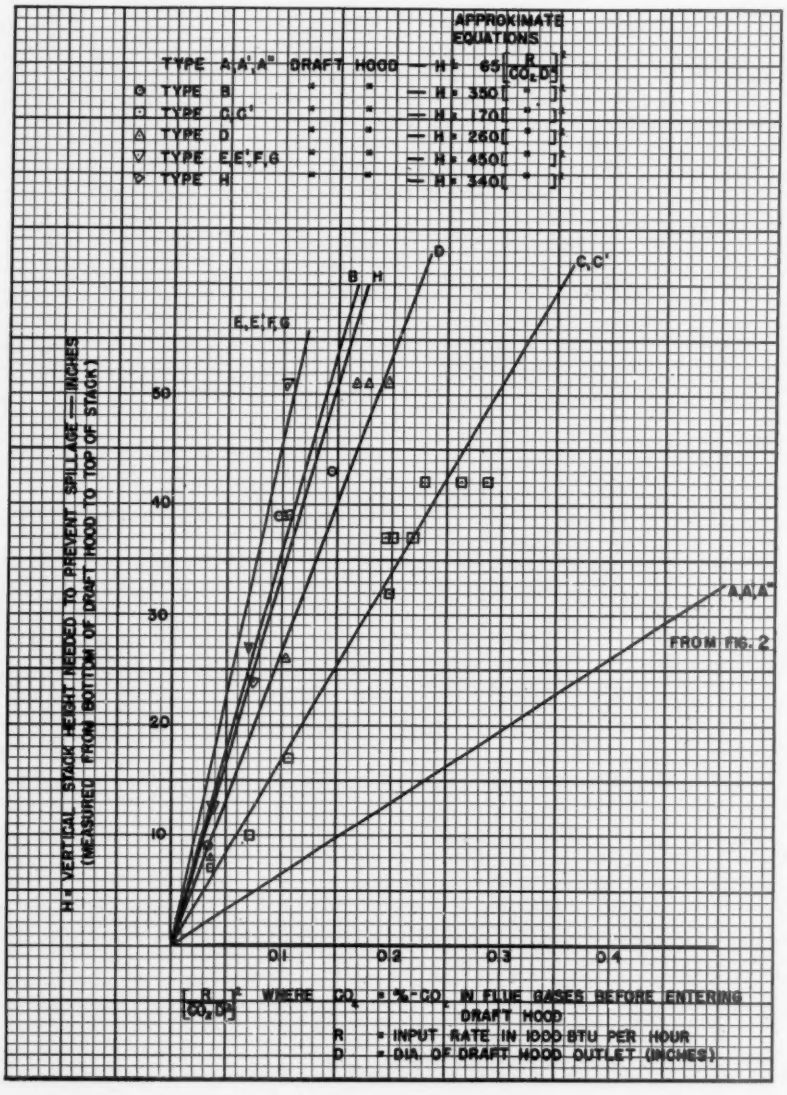

APPROXIMATE EQUATIONS
TYPE A,A',A'' DRAFT HOOD — H = 65 [R/(CO2 D2)]2
TYPE B — H = 350 [R/(CO2 D2)]2
TYPE C,C' — H = 170 [R/(CO2 D2)]2
TYPE D — H = 260 [R/(CO2 D2)]2
TYPE E,E',F,G — H = 450 [R/(CO2 D2)]2
TYPE H — H = 340 [R/(CO2 D2)]2
H = VERTICAL STACK HEIGHT NEEDED TO PREVENT SPILLAGE — INCHES (MEASURED FROM BOTTOM OF DRAFT HOOD TO TOP OF STACK)
50
40
30
20
10
0.1
0.2
0.3
0.4
B, H
D
C,C'
E,E',F,G
A,A',A''
FROM FIG. 2
WHERE CO2 = % - CO2 IN FLUE GASES BEFORE ENTERING DRAFT HOOD
R = INPUT RATE IN 1000 BTU PER HOUR
D = DIA. OF DRAFT HOOD OUTLET (INCHES)

Fig. 3. Relation between $\left[\frac{R}{CO_2 D^2}\right]$ *and height of stack needed to prevent spillage with draft hoods of type A to H, inclusive, utilizing natural gas*

Where:
K_3 = constant for C_1 and C_2

It may be shown by employing the method of calculating weight of flue gases in pounds per hour in "Combustion" (Table 29, page 38) the weight of combustion products of Cleveland natural gas per cubic foot of gas burned is 0.0738 pounds as compared to 0.0765 for air (at standard conditions). Since flue gases are generally diluted to an appreciable extent by excess air, it may be assumed that "S" (specific gravity) of the flue gases is practically the same as that of air, which is unity.

By substituting actual values of H, R_1, D, T_1, T_2 and CO_2 in equation (10) K_2 was found to be equal to approximately (—300). It was then possible to show that for temperature extremes of 200° F. to 400° F. which are average minimum and maximum flue temperatures obtained with contemporary gas water heaters, the expression $\left(1+\frac{K_2}{T_2}\right)$ equals 0.546 and 0.651 respectively. It will thus be seen that the quantity $\left(1+\frac{K_2}{T_2}\right)$ varies but slightly over these extremes in flue gas temperatures and for all practical purposes it may be assumed to be constant.

Likewise, within the same temperature range substitution of values of CO_2 concentrations between 4.0 and 8.0 per cent which may be considered as the range encountered with contemporary water heaters, as substantiated by figures obtained during this investigation, reveals that the expression:

$$\left[\frac{1.04+0.846\left(\frac{12.2-CO_2}{CO_2}\right)}{\frac{1}{T_2^2}\left(\frac{T_2}{T_1}-1\right)}\right]$$ is approximately proportional to $1/(CO_2)^2$.

It may therefore be reasonably simplified to $1/(CO_2)^2$ and the temperature of flue gases may be eliminated as an important variable. Thus equation (10) becomes:

$$H=K\left[\frac{R}{CO_2\,D^2}\right]^3 \quad \ldots\ldots\ldots\ldots\ldots\ldots (11)$$

To obtain values of "K" for standard A. G. A. vertical draft hoods, height of stack required to prevent spillage was plotted against the expression $\left(\frac{R}{CO_2\,D^2}\right)^3$.

Results are shown in Figure 2. As may be seen readily, most of the points fall on a straight line. The few departures were obtained with heaters having inputs greater than 4,000 B.t.u. per hour per square inch of draft hood area, thus indicating that this empirical formula does not apply under such conditions. Values of "K" for the other types of draft hoods were obtained similarly and are shown in Figure 3.

It is interesting to note that comparative spillage performance of these draft hoods are indicated by the magnitude of their "K" values. For example, as shown in Figure 3, where 10 inches of vertical stack height is required for a type A (K = 65) draft hood to prevent spillage 25 inches are needed with a type C (K = 170), and 40 inches with type D (K = 260). Critical performance may be expected with types B (K = 350) and H (K = 340) while types E, F and G (K = 450) would be unsatisfactory at this point. Valuable information is thus provided to insure against spillage troubles in practice.

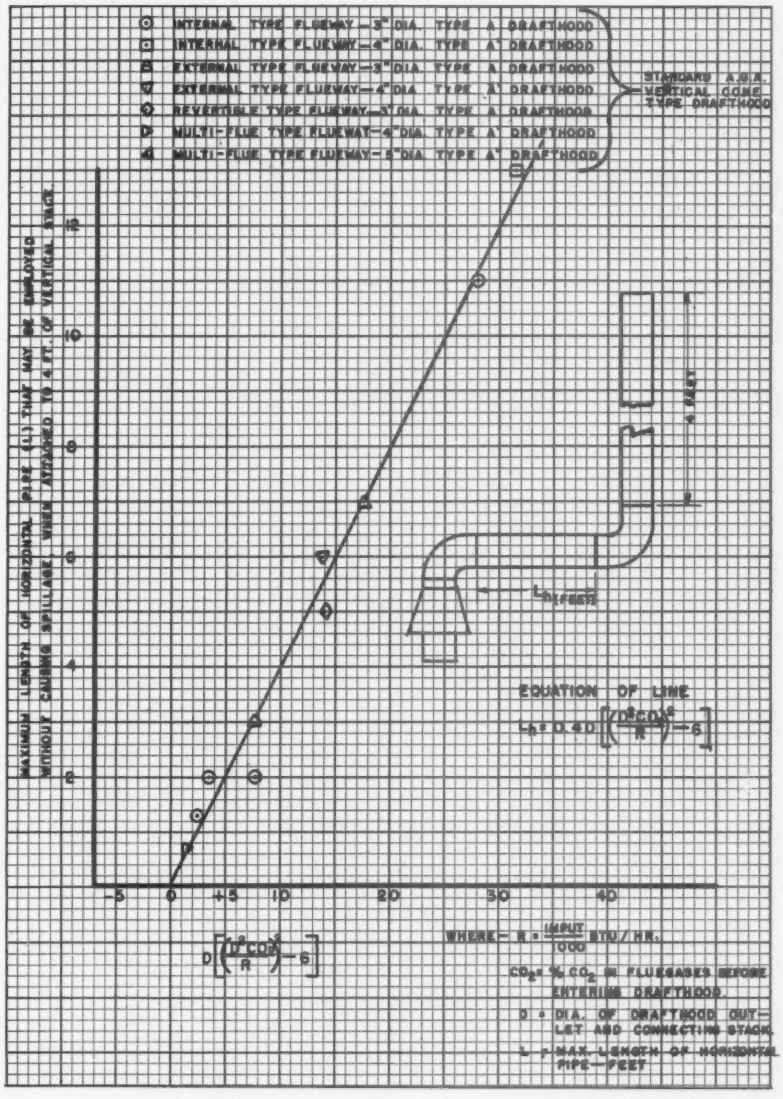

INTERNAL TYPE FLUEWAY—3" DIA. TYPE A DRAFTHOOD
INTERNAL TYPE FLUEWAY—4" DIA. TYPE A DRAFTHOOD
EXTERNAL TYPE FLUEWAY—3" DIA. TYPE A DRAFTHOOD
EXTERNAL TYPE FLUEWAY—4" DIA. TYPE A DRAFTHOOD
REVERSIBLE TYPE FLUEWAY—3" DIA. TYPE A DRAFTHOOD
MULTI-FLUE TYPE FLUEWAY—4" DIA. TYPE A DRAFTHOOD
MULTI-FLUE TYPE FLUEWAY—5" DIA. TYPE A DRAFTHOOD
STANDARD A.G.A. VERTICAL CONE TYPE DRAFTHOOD
MAXIMUM LENGTH OF HORIZONTAL PIPE (L) THAT MAY BE EMPLOYED WITHOUT CAUSING SPILLAGE, WHEN ATTACHED TO 4 FT. OF VERTICAL STACK
4 FEET
2
L IN FEET
EQUATION OF LINE
WHERE— H = INPUT / 1000 BTU/HR.
CO_2 = % CO_2 IN FLUE GASES BEFORE ENTERING DRAFTHOOD
D = DIA. OF DRAFTHOOD OUTLET AND CONNECTING STACK
L = MAX. LENGTH OF HORIZONTAL PIPE—FEET

Fig. 4. Relation between $D\left[\left(\frac{D^2\,CO_2}{R}\right)^2-6\right]$ *and maximum length of horizontal stack that may be employed with a 4-ft. vertical stack without spillage, utilizing Cleveland natural gas*

Since a large number of water heaters are installed in the field at varying distances from a chimney, a horizontal or slightly pitched flue connection is necessary. A long horizontal run naturally tends to reduce effective updraft at the draft hood outlet. Obviously a draft hood designed to prevent spillage with the least amount of stack will give the most satisfactory performance in this respect when used with a horizontal flue connection. Possibilities of an accurate estimate of the maximum length of horizontal flue that may thus be employed when connected to 4 feet of vertical stack are shown by the following extension of the above derivation.

Assuming a vertical draft hood is connected to a 4-foot vertical stack by 2 standard 90° elbows and a horizontal flue, "L_h" feet long, each section having a diameter equal to that of the hood, equation (5) for frictional velocity head becomes:

$$h_f = \frac{KV^2}{T_2}\left[f_d \frac{L_d}{D} + f_v \frac{L_v}{D} + f_e \frac{L_e}{D} + f_h \frac{L_h}{D}\right] \quad \text{(12)}$$

(draft hood; vert. stack; 2 elbows; horiz. pipe)

This may be simplified by assuming that $\frac{L_d}{D}$ is constant for any one type of draft hood and $f_v \frac{L_v}{D}$ is small compared to other frictional losses. In addition the frictional loss through elbows may be considered constant and equation (12) becomes:

$$h_f = \frac{KV^2}{T_2}\left(K_1 + K_2 \frac{L_h}{D}\right) = \frac{K_3 V^2}{T_2} + \frac{K_4 L_h V^2}{D} \quad \text{(13)}$$

Substituting equations (3) and (13) in the fundamental equation for flow of fluids in equation (4) we obtain:

$$V = \left[\frac{2g}{12}(h_v - h_f)\right]^{1/2} = K\left[H\left(\frac{T_2}{ST_1} - 1\right) - \frac{K_3 V^2}{T_2} - \frac{K_4 L_h V^2}{D}\right]^{1/2} \quad \text{(14)}$$

Height of stack needed to prevent spillage was previously shown to be largely independent of temperature, therefore assuming temperature constant, considering "H" as 4 feet, and solving for L_h:

$$L_h = \frac{K_1 D}{V^2} - K_2 D \quad \text{(15)}$$

Substituting the values obtained in equation (9) for "V," eliminating the temperature T_2 and assuming the expression containing CO_2 equals $1/(CO_2)$, for Cleveland natural gas, then:

$$L_h = KD\left[\left(\frac{D^2 CO_2}{R}\right)^3 - K_1\right] \quad \text{(16)}$$

Dividing both sides of equation (16) by "D" we obtain:

$$\frac{L_h}{D} = K\left[\left(\frac{D^2 CO_2}{R}\right)^2 - K_1\right] \quad \text{(17)}$$

Constants "K" and "K_1" were determined for standard A. G. A. vertical cone type draft hoods by conducting tests on 11 heaters. Ratio of observed length of horizontal stack which could be employed without spillage to its diameter was then plotted against value of $\left(\frac{D^2 CO_2}{R}\right)^2$, and resulting straight line employed for calculation of the two constants "K" and "K_1." These were found to be 0.4 and 6.0 respectively. Figure 4 was then prepared to show directly the relation between the maximum length of horizontal stack and the expression $D\left[\left(\frac{D^2 CO_2}{R}\right)^2 - 6\right]$. As will be noted, it was possible to draw a straight line through the points indicated. It thus may be assumed that the formula as developed may be used to predict the maximum length of horizontal flue which can be used without spillage when attached to a 4-foot vertical stack. This assumption is further supported by the fact that the lengths of stack obtained by use of this formula were found in reasonably good agreement with those obtained by actual observation.

It will be apparent that the expression $\left(\frac{D^2 CO_2}{R}\right)^2$ is the reciprocal of that shown in equation (11) for height of vertical stack required to prevent spillage. If the value of this reciprocal is solved in this equation and the necessary substitution made in equation (16) for the particular conditions employed, we obtain:

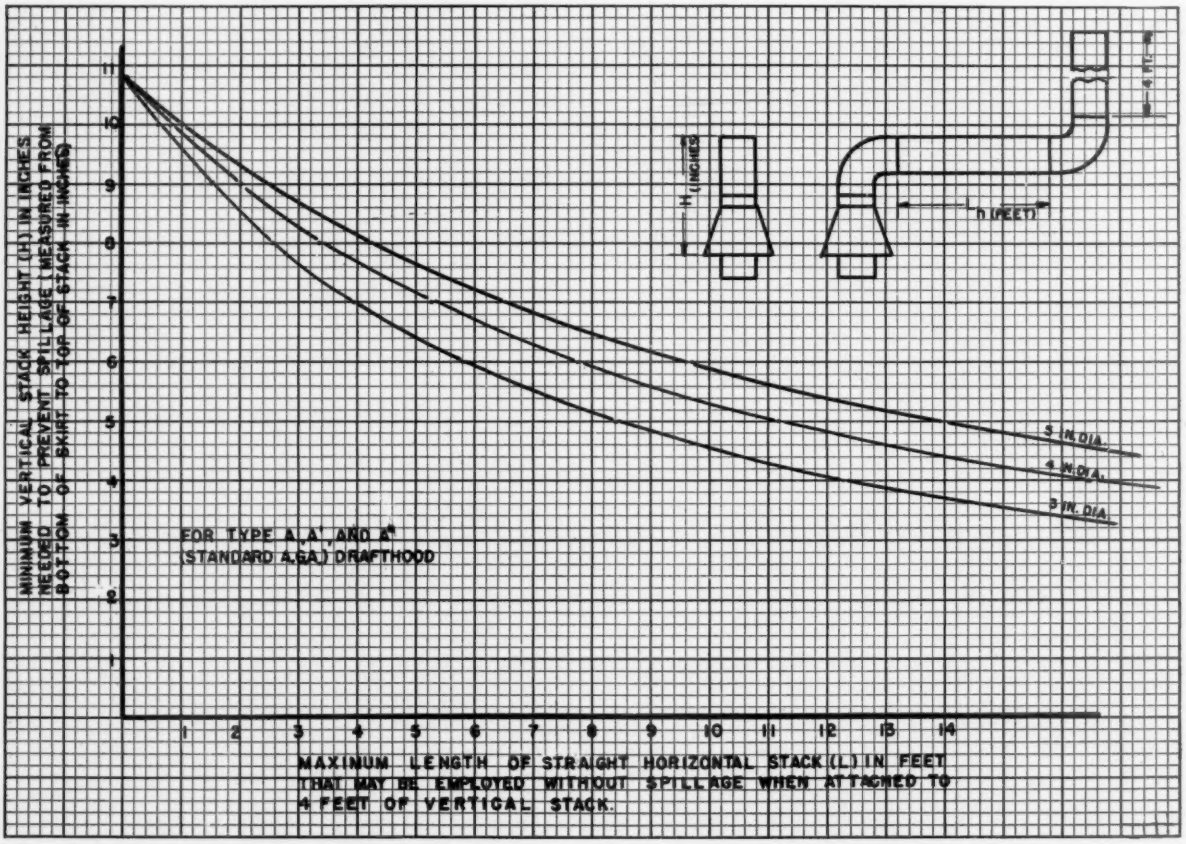

MINIMUM VERTICAL STACK HEIGHT (H) IN INCHES NEEDED TO PREVENT SPILLAGE (MEASURED FROM BOTTOM OF SKIRT TO TOP OF STACK IN INCHES)
FOR TYPE A, A' AND A* (STANDARD A.G.A.) DRAFTHOOD
MAXIMUM LENGTH OF STRAIGHT HORIZONTAL STACK (L) IN FEET THAT MAY BE EMPLOYED WITHOUT SPILLAGE WHEN ATTACHED TO 4 FEET OF VERTICAL STACK.
H (INCHES)
L h (FEET)
H = 4 FT.
5 IN. DIA.
4 IN. DIA.
3 IN. DIA.

Fig. 5. Relation between minimum stack height needed to prevent spillage and maximum length of horizontal stack that may be employed without spillage, when attached to 4 ft. of vertical stack utilizing Cleveland natural gas

$$L_h = 0.4\,D\left[\frac{65}{H} - 6\right] \quad \ldots\ldots\ldots (18)$$

This denotes relationship between minimum stack height needed to prevent spillage and maximum horizontal stack length that can be employed without spillage when attached to 4 feet of vertical stack. Curves are shown for 3 sizes of draft hoods in Figure 5 to present this relationship. The increase in length of horizontal stack which may be employed with increase in size of draft hood is readily apparent.

It must of course be remembered that considering the derivation of the formula employed, the curves shown can be applied only to the particular conditions described. Nevertheless, it is believed that they possess considerable significance in indicating steps which might be taken toward preparation of similar graphs based on other conditions. This may readily be done by following the procedures described herein. It is hoped that they may be of assistance to anyone desiring to develop data along similar lines.

INDUSTRIAL GAS EQUIPMENT PROGRESS

(Continued from page 141)

this method and rely upon the equipment manufacturer to apply his experience and ingenuity to so heat these furnaces as to cause the least possible damage to the retorts and to increase their life to the maximum possible extent.

It is gratifying to state that to date the application of industrial gas to this operation seems to have been most successful in securing maximum production per hour of retort life which makes another distinct contribution to the war program.

Expanded Volume of Equipment

A great many other examples could be cited to show the active part that industrial gas has played in this war effort. The few cases mentioned have brought to the fore the quality of the task performed in taking full advantage of the fuel through well designed equipment. But there is also a quantitative factor involved which is of considerable magnitude. It has been calculated that the combined furnace equipment of the past twenty-four months has about equalled all cumulative previous furnace business as measured in dollars. It is known that in the case of one equipment manufacturer, the furnace sales in the past eighteen months have equalled the volume of the past eighteen years and the total connected load added during these eighteen months is approximately five million cubic feet per hour of one thousand B.t.u. gas. And practically all this equipment represents a capital expenditure of a permanent nature. Very few of these furnaces have been built with the idea of tearing them down soon after the war. They represent in the main equipment tied to the distribution systems of a great many gas utilities. They also represent the culmination of years of research, years of improvement in processes and equipment and years of effort in selling the idea of gas to industry.

The Post War Period

Now, what of tomorrow? We know that, whatever the details of the peace settlement, the production of shell and shot and guns and tanks will come to an end with cessation of hostilities. Once more industry will have to convert and this time from war goods to peace goods. Some of the equipment, now in such active production, will lie dormant for a period depending upon how quickly the swing can be made. Some equipment will be passive for a long time but subject to call in emergency. Some of it will go to the scrap heap. In any event for a time of unknown duration the utilities will suffer a loss of load.

It is a safe prediction that this load will pick up the quicker, the better and more versatile the equipment which has been installed on their lines. But this alone will not suffice. Newer methods must pave the way. Once more research must become the handmaiden of progress. It is difficult to predict the direction it will take. Much has been said concerning the future use of plastics. Some enthusiasts go so far as to say that plastics will revolutionize the manufacture of many articles, particularly the automobile. Should this occur, there is no doubt but that it will considerably affect the sale and use of heat-treating furnaces. But no one has yet suggested the use of plastics for a transmission gear. On the other hand, instead of forging, machining and carburizing these gears, it is suggested that they might be processed through powdered metallurgy. This too would affect the sale and use of furnacing equipment, not by their elimination but by replacement with equipment of different type.

One thing is certain. After a brief breathing period we will find the tempo of industrial progress accelerating at a pace heretofore unknown. Competition will spring from unexpected quarters. Obsolescence of equipment will be no quicker than obsolescence of kinds of business. In other words, we have no assurance that we shall continue to sell industrial gas and gas-fired furnaces. Whatever it may be that we shall sell, we do know that the world will continue to pay tribute to those individuals, groups and businesses that stand at the forefront of progress in rendering a better service than had been rendered heretofore. And the same methods which have so well succeeded in the past will again succeed in the future, that unremitting effort which is compounded of research, cooperation, foresight and tireless work. It is a prescription which has never failed any business, anywhere, at any time.

GAS INDUSTRY WAR ACTIVITIES

(Continued from page 129)

consumption requires approximately 500 gallons of oil annually for each gas house heating job while the average residential oil burner has an annual consumption of 2,000 gallons of oil.

In replying to the suggestion of the Petroleum Administration, the Association pointed out that it would obviously be necessary to convert four gas house heating customers to coal as against one oil burner customer, and that, in view of the additional expense, inconvenience and use of critical materials involved, the end would not appear to justify the means. Although the oil industry has not to my knowledge solicited such conversion through advertising to its customers, the government has advocated conversions from oil to coal both in homes and in in-

dustry over a period of from 12 to 15 months. Industrial conversions to date represent a saving of approximately 100,000 barrels of heavy oil daily, and residential conversions numbering more than 100,000 represent a saving of approximately 15,000 barrels daily. Comparable success in a voluntary gas conversion program would represent a saving of only 300 barrels of oil daily. In spite of these facts, it is possible that this proposal will be presented again before the next heating season.

I have discussed here only a few of the current war activities of the gas industry. Many others, including the salvage and exchange of materials, the administration and interpretation of Orders L-31 and L-174, the war protection of the gas industry, and the services which the Association and industry have rendered to the Office of Civilian Defense and the Office of Strategic Services are no less important than those which I have reviewed. They are all essential to the effective prosecution of the war and are receiving the careful consideration and attention of highly competent committees and personnel of the industry. In most instances, however, they are less controversial than the matters which I have covered, and for lack of time may be relegated for the moment to cloakroom and after-dinner discussions.

Wartime Recipes

MORE than 5000 sets of wartime recipes have been distributed by the home service division of The Philadelphia Gas Works Company in the last two and one-half months, it is reported by Beatrice Cole Wagner, home service director. Planned to fit the food rationing program, each set consists of eight sections, averaging five pages each, including marketing suggestions as well as cooking hints.

The subjects of this group are: Sugar Substitutes, Economical Meats, Meat Specialties, Suggestions for "Meatless Days," How to Serve Apples Every Day, Nutritious Puddings, Favorite Soups, and Menus for War Worker's Lunchbox. Recipes soon to be added cover Poultry Cookery and Fish Cookery.

One month the background of the display window at Broad & Arch Streets consisted of a large photograph of various food materials featured in the recipes.

Courtesy, *Daily Sketch*

"Understand—you've got to write 'I must keep within my fuel target' a thousand times, and hand it to me at the gas company's office tomorrow morning"

New Jersey Gas Sales Up

GAS sold to customers of Public Service Electric & Gas Co., Newark, N. J., in 1942 totalled 33,957,025,600 cubic feet, a gain of 12.28 per cent over 1941. Sales of gas for industries were 47.67 per cent more than in 1941. The industrial sales were the largest in any year due to demand by war production plants. A number of manufacturers using large quantities of gas located in Public Service territory during 1942 and other important industries increased their annual requirements. Gas sold to residential customers, exclusive of building heating, was 2.92 per cent more than in 1941. Gas meters in service December 31, 1942 numbered 906,670, a net gain of 16,392 for the year.

Europe's Public Utilities

AFTER defeat the German and German-appointed officials in the occupied countries will be eliminated while the former native staff, or certainly many of them, will through death or exile, not be available. The restoration of order, the distribution of food, the repatriation of refugees and prisoners, and demobilization, will create many new problems for the public services. Vast quantities of new rolling stock, machinery, and other apparatus will be needed, which the ruined or damaged factories of Europe will be unable fully to supply . . . . some timely plans are needed. —(From article in the London *Times*)

War Item

WHEN asked to fill out a questionnaire by the A. G. A. statistical department, the owner of a southwestern gas producing company wrote:

"We are all gone to war, or working 12 or 16 hours per day to keep our part of the world together. War industries have taken all the folks worth a durn, and we can't find anyone who can make these reports.

"The writer and owner has three sons and two sons-in-law in the Army Air Force, is 61 years old, have been in bed half the winter with a bad heart and nervous bust up, and am trying to run my office myself with my wife and a 15-year-old daughter, the daughter is in school, and the two do all the housework.

"Am sorry, but we have a stak of MUST work two feet high on hand now."

More Gas for Vehicles in Germany

EVERY vehicle in Germany which can be operated by gas is to be put on gas as soon as possible, within the limits of supply. Germany had 22,000 coal gas driven vehicles in 1937, 40,000 in 1939, and 200,000 by the end of last year.—*The Gas Times*—January 30, 1943.

Personnel Service

SERVICES OFFERED

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